0010810

WHC-EP-0342
Addendum 7

UO_3/U-Plant Wastewater Stream-Specific Report

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.
The U.S. Department of Energy and its contractors can obtain copies of this report from:
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401
This report is publicly available from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Printed in the United States of America

DISCLM-1.CHP (7-90)

START

0010810 104

WHC-EP-0342
Addendum 7

UO_3/U-Plant Wastewater Stream-Specific Report

9 1 1 1 7 5 0 5 9 4

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

THIS PAGE INTENTIONALLY
LEFT BLANK

START

WHC-EP-0342
Addendum 7

UC-630

UO_3/U-Plant Wastewater Stream-Specific Report

W. E. Toebe
L. L. L. Adams
D. C. Hedengren

Date Published
August 1990

5 0 5 0 5 3 1 1 1 9

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

THIS PAGE INTENTIONALLY
LEFT BLANK

UO_3/U PLANT WASTEWATER STREAM-SPECIFIC REPORT

W. E. Toebe
L. L. L. Adams
D. C. Hedengren

ABSTRACT

The proposed wastestream designation for the UO_3/U Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations.* *A combination of process knowledge and sampling data was used to make this determination.*

9 0 5 0 5 7 3 1 1 1 7

---

*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

This page intentionally left blank.

EXECUTIVE SUMMARY

The proposed dangerous waste designation for the UO_3/U Plant Wastewater stream located in the 200 West Area at the Hanford Site is that the stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*.* This stream consists primarily of cooling water and steam condensate from the UO_3 Plant. A combination of process knowledge and current sampling data was used to determine if the effluent contains a listed dangerous waste (WAC 173-303-080). Process data, contained in Section 2.0 of this report, were based on present operating or process knowledge and chemical inventory information. Sample data were based on samples taken downstream of all potential contributors between October 1989 and March 1990 ("new data"). The listed dangerous waste determination was made using process data supplemented by sample data. The criteria and characteristic dangerous waste determinations were made using sample data only.

*Ecology, 1989, *Dangerous Waste Regulations*, Washington (State) Administrative Code (WAC) 173-303, Washington State Department of Ecology, Olympia, Washington.

This page intentionally left blank.

LIST OF TERMS

BAT	best available technology
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
DCG	derived concentration guide
DOE	U.S. Department of Energy
DWS	Drinking Water Standards
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
HH	halogenated hydrocarbons
HVAC	heating, ventilation, and air conditioning
IARC	International Agency for Research on Cancer
MCL	maximum contaminant level
MSDS	Material Safety Data Sheets
PAH	polycyclic aromatic hydrocarbons
PUREX	Plutonium-Uranium Extraction
REDOX	Reduction-oxidation
SARA	*Superfund Amendment Reauthorization Act*
UNH	uranyl nitrate hexahydrate
WAC	Washington (State) Administrative Code

This page intentionally left blank.

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

This page intentionally left blank.

UO_3/U PLANT WASTEWATER STREAM-SPECIFIC REPORT

1.0 INTRODUCTION

1.1 BACKGROUND

In response to the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), comments were received from the public regarding reduction of the discharge of liquid effluents into the soil column. As a result, the U.S. Department of Energy (DOE), with concurrence of the Washington State Department of Ecology (Ecology), and the U.S. Environmental Protection Agency (EPA), committed to assess both the waste disposal and health risks of liquid discharges at the Hanford Site (Lawrence 1989).

This assessment is described in the *Liquid Effluent Study Project Plan* (WHC 1990a), a portion of which characterizes 33 liquid effluent streams. The characterization addresses the following elements: process description, sampling data, and dangerous waste regulations designations contained in the Washington (State) Administrative Code (WAC) 173-303 (Ecology 1989).

The results of the characterization study are documented in 33 separate reports, one report per wastestream. The complete list of stream-specific reports is provided in Table 1-1. This document, which is Addendum 7 of the 33 reports, is for the UO_3/U Plant Wastewater.

1.2 APPROACH

This report characterizes the UO_3/U Plant Wastewater stream, located in the 200 West Area at the Hanford Site, in sufficient detail so that a dangerous waste designation, in accordance with WAC 173-303, can be proposed. Another objective of this study is to ensure that fluctuations have been described in sufficient detail to predict present operations. The final objective of the program is to gain Ecology's acceptance of the proposed designation in accordance with WAC 173-303 so an assessment of the relative effluent priorities can be made with regard to the need for treatment and/or alternative disposal practices.

This characterization effort is implemented according to the strategy outlined in Figure 1-1 and consists of the following steps:

- Provide both process and sample data (Sections 2.0 and 3.0)
- Evaluate the data (Section 4.0)

- Propose a designation (Section 5.0)
- Develop an action plan, if necessary, to obtain additional characterization data (Section 6.0)

1.3 SCOPE

This document characterizes the UO_3/U Plant Wastewater. Currently, this stream is discharged into the 207-U Retention Basins and then into the 216-U-14 Ditch (see Figure 1-2). Prior to discharge to the ditch, the stream is continuously monitored for pH and is flow-proportionally sampled. Historical data are presented for both radioactive and nonradioactive constituents in the UO_3/U Plant Wastewater. The liquid discharge data are "new data" taken during the period October 1989 through March 1990. "New data" refers to data taken from October 1989 through March 1990. "Old data" refers to data from samples collected prior to October 1989. The new data are used for proposing the wastestream designation, calculating "loadings," maximum contaminant level (MCL) comparisons, etc., whereas old data are presented for informational purposes only.

Historical changes, process campaign changes, and sampling data are considered relevant to the characterization of the UO_3/U Plant Wastewater. Future configuration and process modifications will only be addressed if they significantly alter the effluent contents.

Table 1-1. Stream-Specific Characterization Reports.

WHC-EP-0342	Addendum 1	300 Area Process Wastewater
WHC-EP-0342	Addendum 2	PUREX Plant Chemical Sewer
WHC-EP-0342	Addendum 3	N Reactor Effluent
WHC-EP-0342	Addendum 4	163N Demineralization Plant Wastewater
WHC-EP-0342	Addendum 5	PUREX Plant Steam Condensate
WHC-EP-0342	Addendum 6	B Plant Chemical Sewer
WHC-EP-0342	Addendum 7	UO_3/U Plant Wastewater
WHC-EP-0342	Addendum 8	Plutonium Finishing Plant Wastewater
WHC-EP-0342	Addendum 9	S Plant Wastewater
WHC-EP-0342	Addendum 10	T Plant Wastewater
WHC-EP-0342	Addendum 11	2724-W Laundry Wastewater
WHC-EP-0342	Addendum 12	PUREX Plant Process Condensate
WHC-EP-0342	Addendum 13	222-S Laboratory Wastewater
WHC-EP-0342	Addendum 14	PUREX Plant Ammonia Scrubber Condensate
WHC-EP-0342	Addendum 15	242-A Evaporator Process Condensate
WHC-EP-0342	Addendum 16	B Plant Steam Condensate
WHC-EP-0342	Addendum 17	B Plant Process Condensate
WHC-EP-0342	Addendum 18	2101-M Laboratory Wastewater
WHC-EP-0342	Addendum 19	UO_3 Plant Process Condensate
WHC-EP-0342	Addendum 20	PUREX Plant Cooling Water
WHC-EP-0342	Addendum 21	242-A Evaporator Cooling Water
WHC-EP-0342	Addendum 22	B Plant Cooling Water
WHC-EP-0342	Addendum 23	241-A Tank Farm Cooling Water
WHC-EP-0342	Addendum 24	284-E Powerplant Wastewater
WHC-EP-0342	Addendum 25	244-AR Vault Cooling Water
WHC-EP-0342	Addendum 26	242-A Evaporator Steam Condensate
WHC-EP-0342	Addendum 27	284-W Powerplant Wastewater
WHC-EP-0342	Addendum 28	400 Area Secondary Cooling Water
WHC-EP-0342	Addendum 29	242-S Evaporator Steam Condensate
WHC-EP-0342	Addendum 30	241-AY/AZ Tank Farms Steam Condensate
WHC-EP-0342	Addendum 31	209-E Laboratory Reflector Water
WHC-EP-0342	Addendum 32	T Plant Laboratory Wastewater
WHC-EP-0342	Addendum 33	183-D Filter Backwash Wastewater

Figure 1-1. Characterization Strategy.

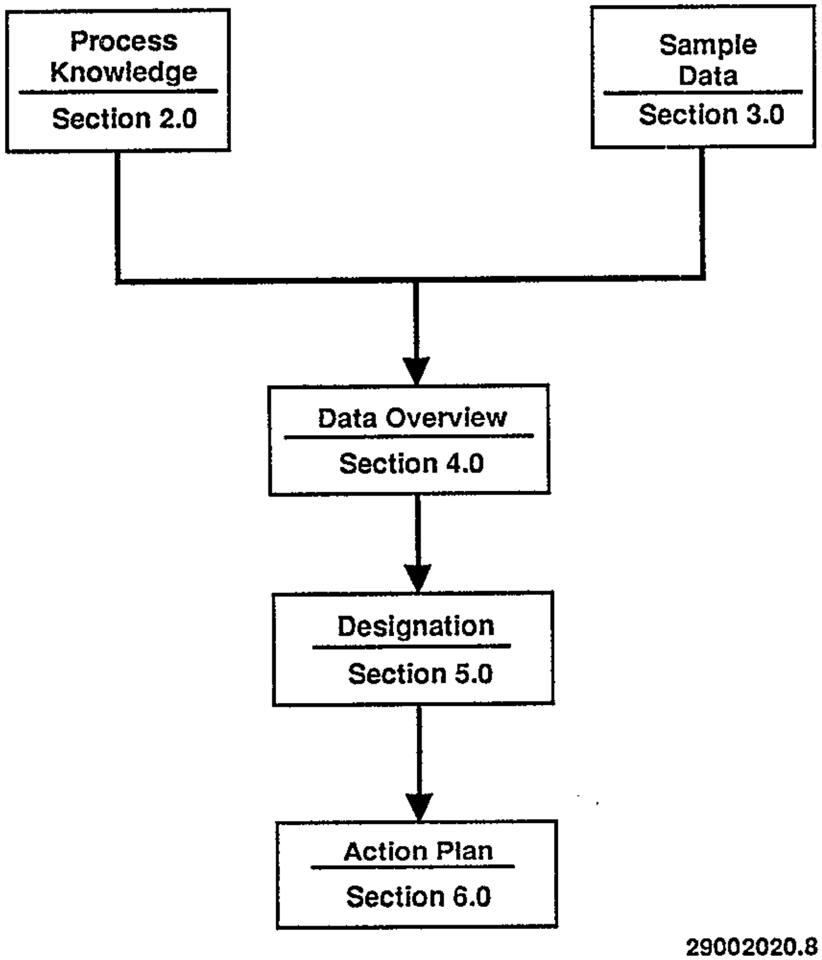
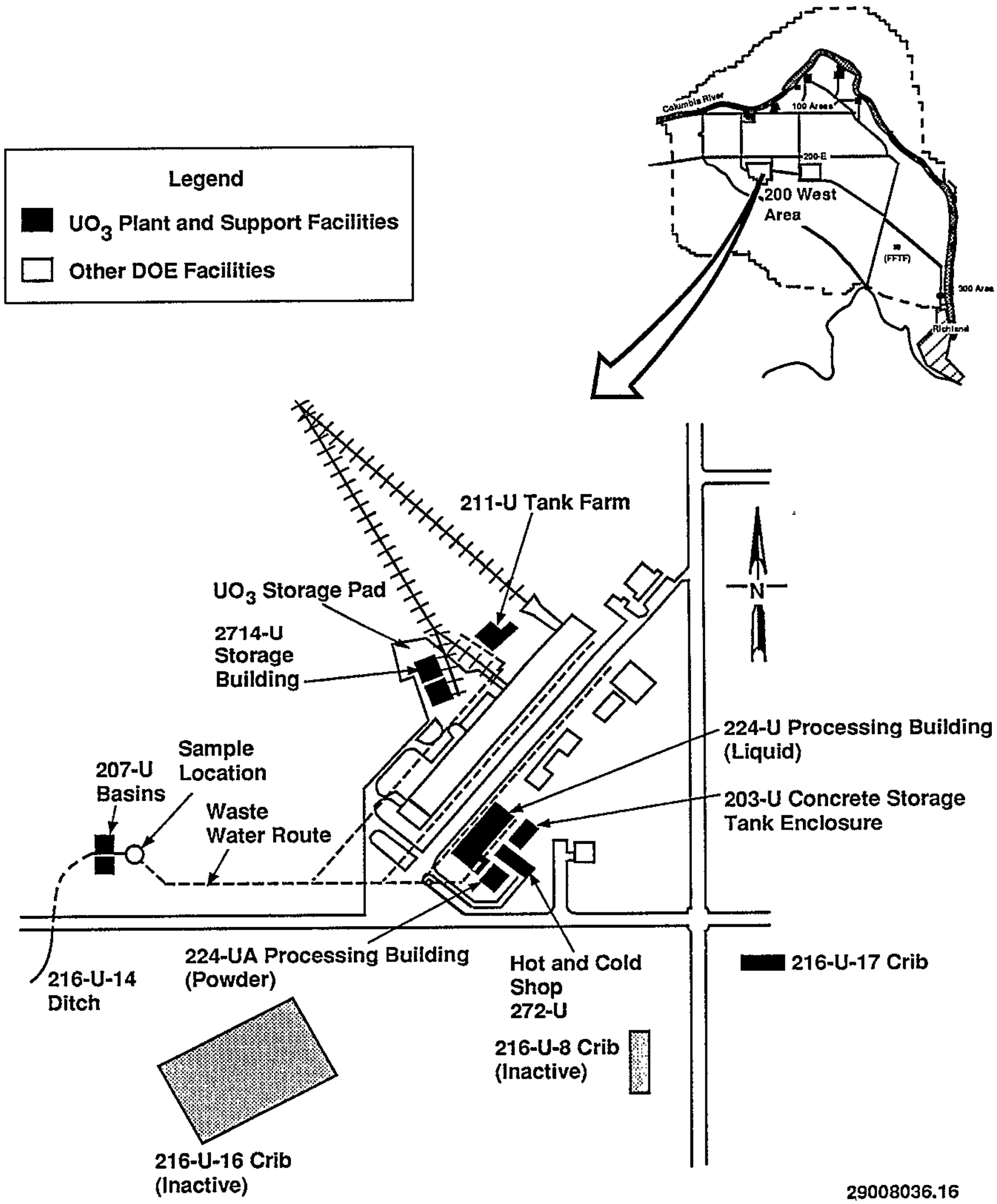


Figure 1-2. UO_3 Plant Site Map.



This page intentionally left blank.

2.0 PROCESS KNOWLEDGE

This section presents a qualitative and quantitative process knowledge-based characterization of the chemical and radiological constituents of the UO_3/U Plant Wastewater. The wastewater stream originates from a number of sources throughout the UO_3 Plant. After describing the location and physical layout of the UO_3 Plant, streams contributing to the wastewater stream will be identified. An overview of the processing activities performed at the facility will lead into a discussion of constituents of the contributors.

2.1 PHYSICAL LAYOUT

The UO_3 Plant is located in the south central portion of the 200 West Area of the Hanford Site. The plant consists of two primary processing facilities, Buildings 224-U and 224-UA and several ancillary facilities as shown in Figure 2-1.

Building 224-U is a roofed concrete-walled building constructed in 1944. The building is 44 m long and 28 m wide. Its principal roof is 12 m above grade. The primary purpose of this building is receiving uranyl nitrate hexahydrate (UNH) solution from the Plutonium-Uranium Extraction (PUREX) Plant and concentrating it for later processing in Building 224-UA. In addition, a nitric acid recirculation loop from Building 224-U scrubs the calciner offgas system in Building 224-UA to dissolve entrained UO_3 fines. Details of the building are shown schematically in Figure 2-2 and Figure 2-3.

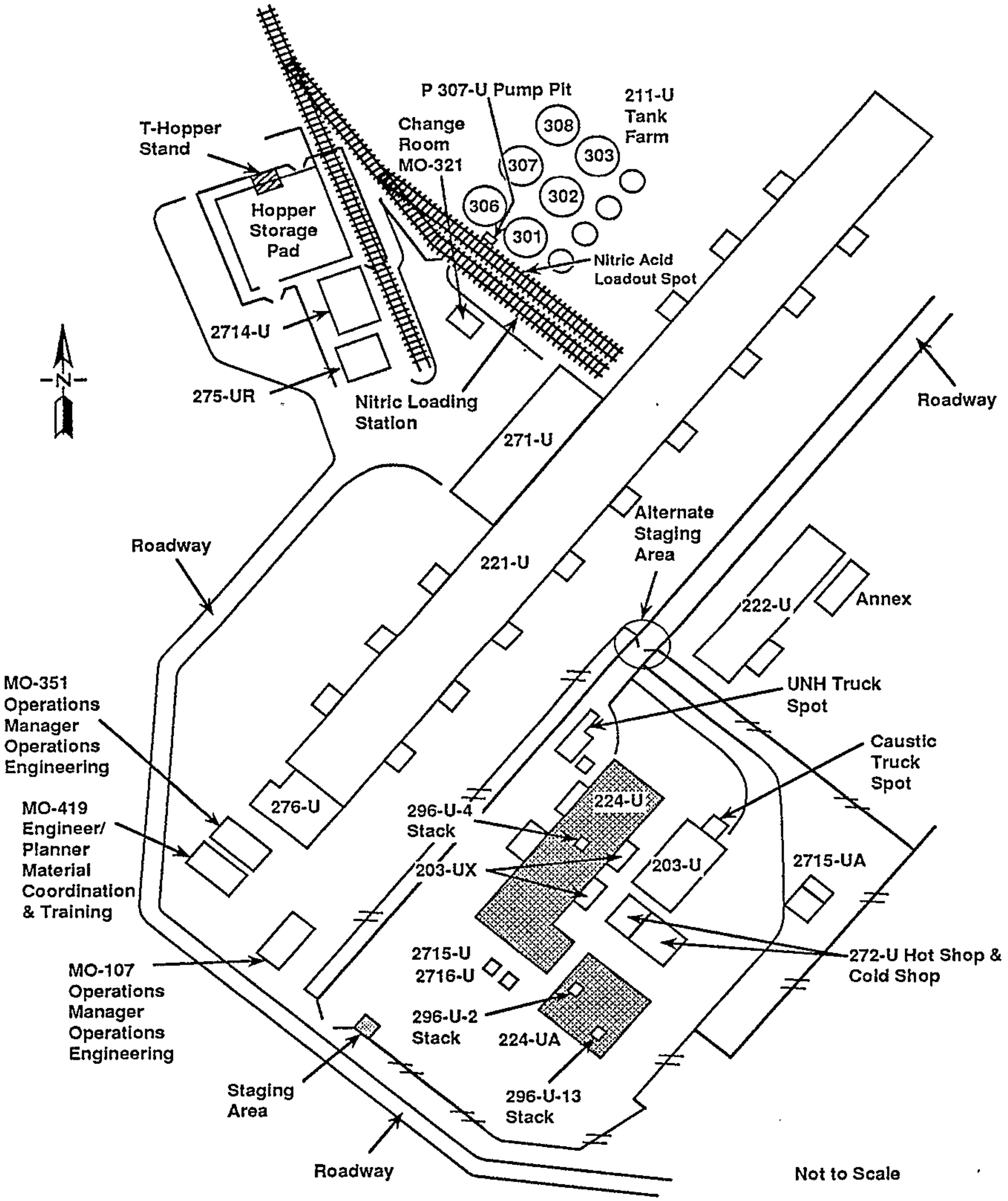
Building 224-UA is a steel-walled and framed building constructed in 1957. The building is 29 m long and 16 m wide. Its principal roof is 8.5 m above grade, although a processing tower extends to 15.5 m above grade. The primary purposes of this building are to convert UNH from Building 224-U to uranium trioxide (UO_3) powder and to package it for off-site shipment. Calciner offgas is routed to the nitric acid recovery system in Building 224-U. Figure 2-4 shows details of the building.

The 203-U enclosure is a concrete-diked process chemical tank storage area. The 203-U enclosure stores feed UNH from PUREX, recycle UNH to be returned to PUREX, process condensate, and potassium hydroxide. Any solutions collected in the 203-U enclosure sump are transferred to Building 224-U for further processing.

The two 203-UX enclosures are adjacent to the 224-U Building. Each enclosure is a concrete-diked process area. The 203-UX enclosures contain additional UNH process vessels and associated equipment and piping.

The "backpad" area between 224-U, 224-UA, and 203-U contains additional tankage and piping connecting the main process buildings. Any rainfall or uranium-bearing solutions collected in sumps in the potentially contaminated backpad area are routed to Building 224-U for further processing.

Figure 2-1. UO_3 Plant and Auxiliary Facilities.



29008036.12

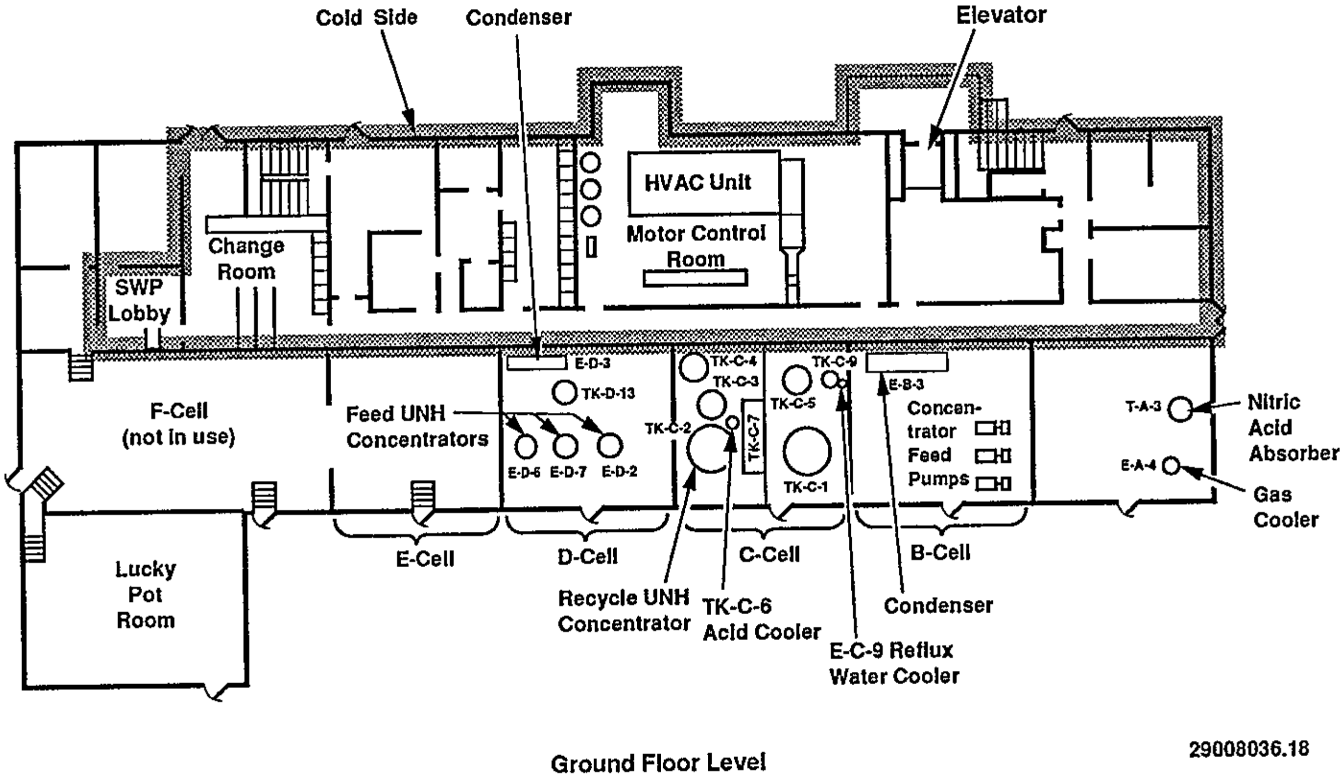


Figure 2-2. Ground Floor, 224-U Building.

Figure 2-3. Second and Third Floors, 224-U Building.

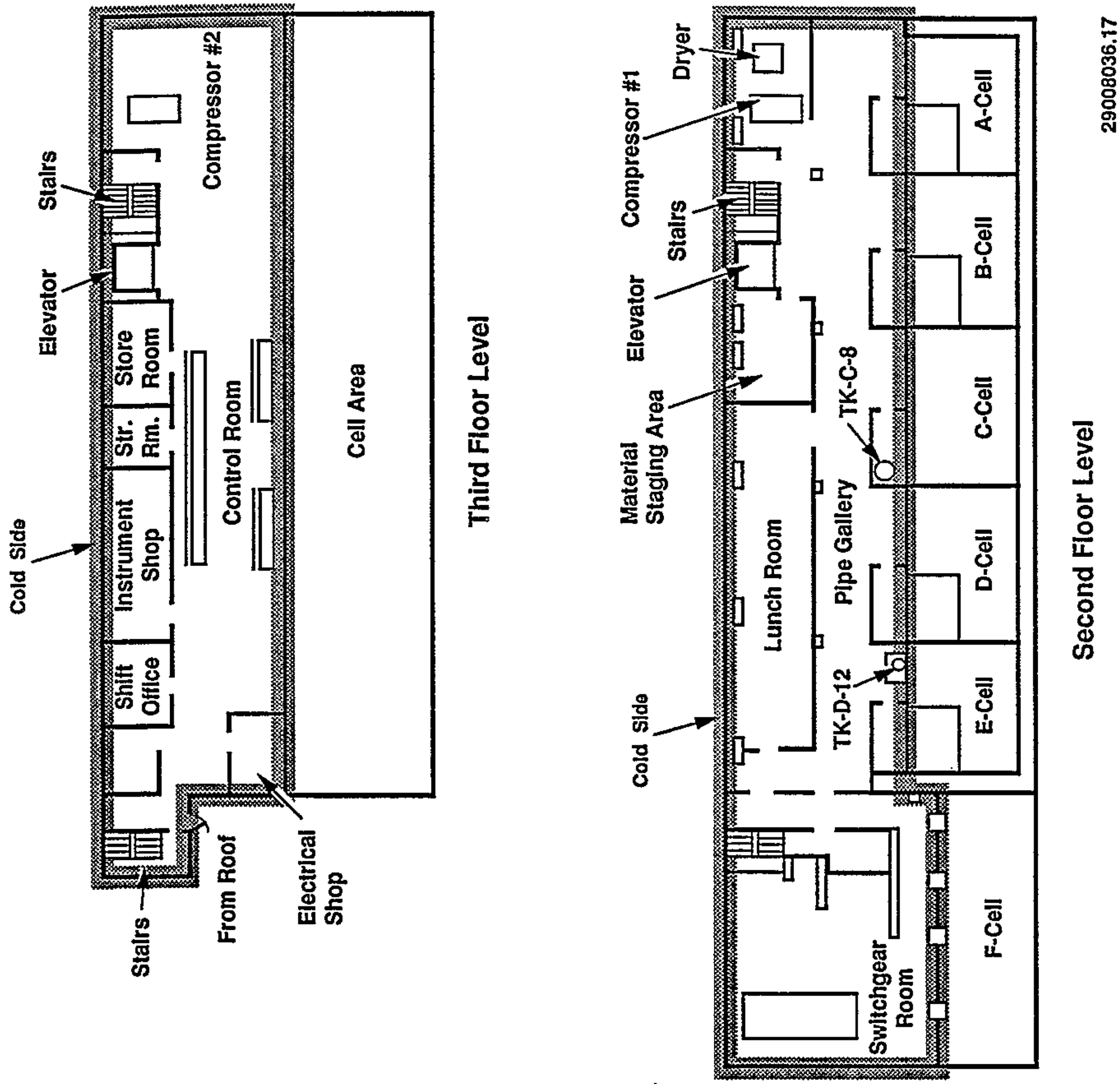
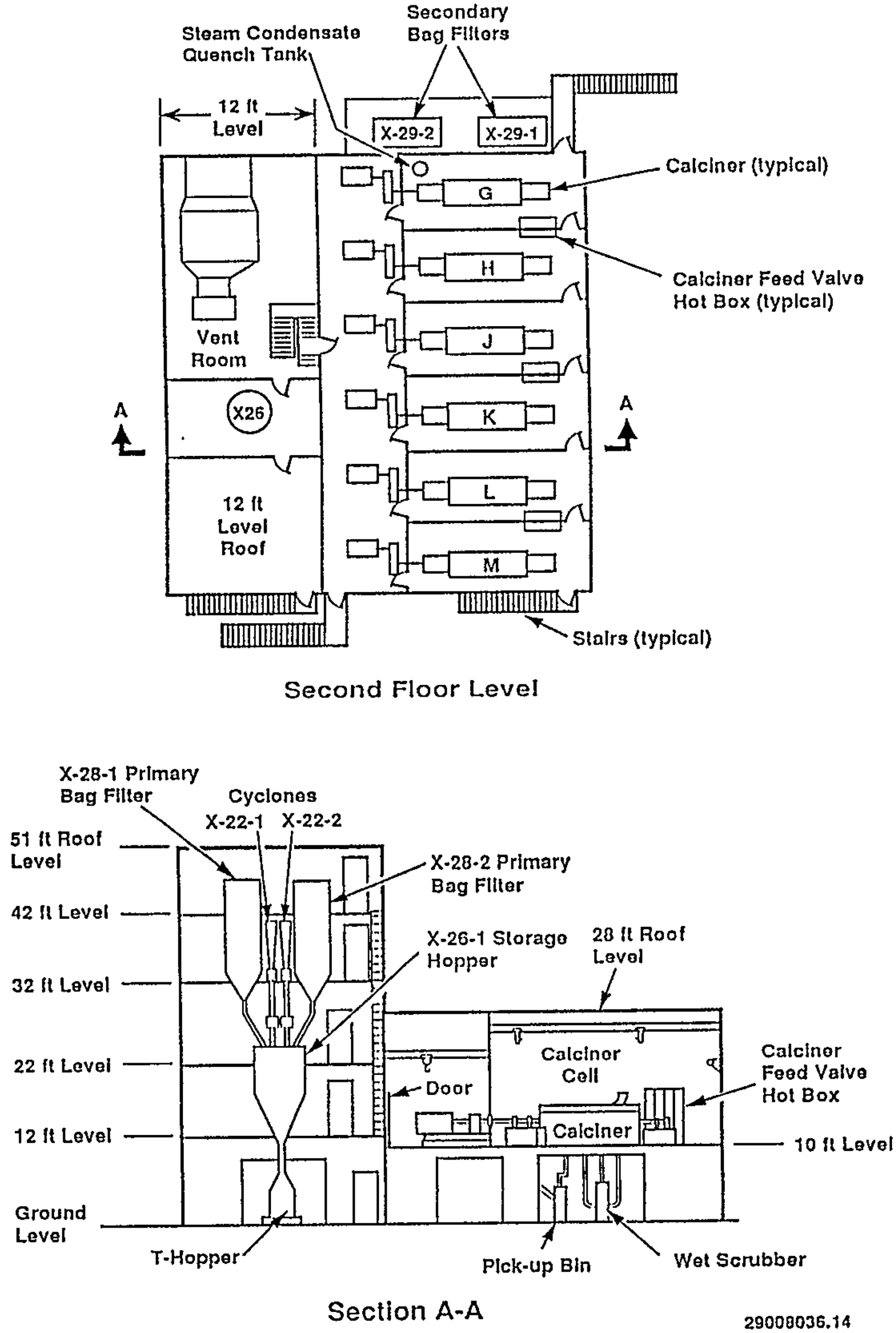


Figure 2-4. 224-UA Building.



The UNH Truck Spot is located at northwest corner of the 224-U Building. This is where the feed and recycle UNH, transported by tank trailer, is received and loaded out.

The Caustic Truck Spot is located adjacent to the northeast side of the 203-U enclosure. This is where the potassium hydroxide solution needed in the plant process is received.

The 211-U Tank Farm contains three storage tanks (Tk) (Tk 306, 307 and 308) where nitric acid recovered at the UO_3 Plant is staged for rail shipment to the PUREX Plant by tank cars. A spare tank (Tk 301) is provided at 211-U for overflow from the storage tanks or for in the event that any of the storage tanks develops a leak. The P 307-U pump pit, located adjacent to the nitric acid storage tanks, contains a nitric acid transfer pump. The pit also collects any drainage from the pipe trench for the nitric acid storage tanks. Two isolation valves in series are installed in the drain line from the pump pit to the wastewater stream. These valves are locked in the closed position. The Nitric Acid Loadout Spot is where the recovered nitric acid is transferred into the railroad tank car for shipment to PUREX. Currently the drain from the loadout spot goes directly to the wastewater stream without isolation valve(s). The nitric acid loadout system is equipped with alarms and automatic shutoff features to prevent overflowing tank cars; however, no loading operations have been conducted since July 1988.

Other pump pits and pipe trenches located at the 211-U area are no longer active. These pump pits and pipe trenches served out-of-service tanks which have not been used for some time and are currently empty. The drainage from these pump pits and trenches also goes directly to the wastewater stream.

Former process and laboratory Buildings 221-U, 271-U, and 222-U are no longer in operation. The 291-U-1 stack continues to exhaust the 221-U canyon air. Drainage and heating, ventilation, and air conditioning (HVAC) condensates from these retired facilities are still routed to the UO_3/U Plant Wastewater system. Currently there is no contribution to the wastewater stream from the "zone side" of the 221-U, 271-U and 222-U Buildings. The "zone side" is an area which is under radiological control.

2.2 CONTRIBUTORS

The contributors to the UO_3/U Plant Wastewater stream are shown in Table 2-1. A map of the physical routing from the contributing facilities is shown in Figure 2-5. The wastewater stream is designed to be a clean stream. Except for off-normal conditions such as catastrophic failure of equipment, none of the contributing sources comes directly in contact with the UNH-containing process fluids.

The wastewater route located southeast of the 221-U Canyon used to discharge cooling water from heat exchangers during the prior operation conducted at U Plant. The flow contribution to this route has ceased since the shutdown of the U Plant process in 1967.

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 1 of 7)

Contributor area/vessel		Source/usage	Typical Flow (L/min) Calcin+	Standby
224-U Building				
Process Area:				
A Cell:	EA-4 condenser	Raw water used as cooling medium.	300	0
	TA-3 acid absorber	Raw water used as cooling medium.	300	0
B Cell:	EB-3 condenser	Raw water used as cooling medium.	640	190
C Cell:	Tk C-6 acid cooler	Raw water used as cooling medium.	190	0
	Tk C-2 Recycle UNH Concentrator	Steam condensate resulting from using steam as heating medium (batch process).	*	*
	Tk C-1 UNH receiving Tank	Steam condensate resulting from using steam for tank heating (non-routine).	*	*
	EC-9 Reflux water cooler	Raw water used as cooling medium.	*	0
D Cell:	ED-3 condenser	Raw water used as cooling medium.	1,140	190
	ED-2, ED-6 & ED-7 concentrators	Steam condensate resulting from using steam as heating medium.	*	0

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 2 of 7)

Contributor area/vessel		Source/usage	Typical Flow (L/min)	
			Calcin+	Standby
224-U Building (continued)				
Nonprocess Area ("Cold Side):				
1st Floor:	Floor drains	Sanitary water from floor flushing.	*	*
	Building HVAC	Steam condensate from building heating.	*	*
		Sanitary water overflow from spray washer (non-routine).	*	*
	Changerooms	Sanitary water from shower drains.	*	*
	Radiator heaters	Steam condensate from room heating.	*	*
	Drinking fountains	Sanitary water drain.	*	*
2nd Floor:	Floor drains	Sanitary water from floor flushing, safety shower and eye washer.	*	*
	Steam traps	Steam condensate from steam lines.	*	*

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 3 of 7)

Contributor area/vessel	Source/usage	Typical Flow (L/min) Calcin+	Typical Flow (L/min) Standby
224-U Building (continued)			
Compressor and dryer	Sanitary water used for cooling purpose in compressor #1 and the refrigerant/desiccator dryer unit.	115	115
	Compressed air condensate from desiccator.	*	*
	Compressed air condensate from coalescent filters, air/water separator, and air receiver.	*	*
Lunchroom HVAC	Steam condensate from lunchroom heating.	*	*
	Sanitary water for lunch-room cooling.	*	*
Radiator heaters	Steam condensate from room heating	*	*
Drinking fountain	Sanitary water drain.	*	*
3rd Floor: Floor drains	Sanitary water from floor flushing, safety shower drain and eye washer drain.	*	*
Instrument shop	Sanitary water from sink drain.	*	*
Compressor #2	Sanitary water used as cooling water.	75	75
	Compressed air condensate from air/water separator.	*	*

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 4 of 7)

Contributor area/vessel	Source/usage	Typical Flow (L/min) Calcin+	Standby
224-U Building (continued)			
Radiator heaters	Steam condensate from room heating.	*	*
Drinking fountain	Sanitary water drain.	*	*
224-UA Building			
UNH feed lines and feed DOVs	Steam condensate from line and hot box heating.	*	*
Building HVAC	Steam condensate from building heating.	*	*
	Sanitary water overflow from spray washer (non-routine).	*	*
G cell quench tank	Sanitary water addition to condensate quench tank. Note: All steam condensate from the 224-UA Building is collected in the quench tank.	75-115	0-75
272-U Shop			
Radiator heaters	Steam condensate from room heating.	*	*
Cold shop floor drain	Sanitary water used for floor flushing.	*	*
Welding machine	Sanitary water used for machine cooling purpose.	*	*
Roof drain	Rain water from building roof.	*	*

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 5 of 7)

Contributor area/vessel	Source/usage	Typical Flow (L/min) Calcin[+]	Standby
	203-U Enclosure		
Tk X-38 recycle UNH storage	Steam condensate resulting from using steam for tank heating (non-routine).	*	*
Tk X-37 process condensate storage	Steam condensate resulting from using steam for tank heating (non-routine).	*	*
Tk X-1 and Tk X-2 UNH storage	Steam condensate resulting from using steam for tank heating.	*	*
Tk X-36 KOH storage	Steam condensate resulting from using steam for tank heating (non-routine).	*	*
Steam traps	Condensate from steam lines.	*	*
	203-UX Enclosure		
Tk X-30 100% UNH storage	Steam condensate resulting from using steam for tank heating.	*	*
Steam traps	Condensate from steam lines.	*	*
Process piping	Steam condensate resulting from using steam for heat tracing process lines.	*	*

Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 6 of 7)

Contributor area/vessel	Source/usage	Typical Flow (L/min) Calcin+	Standby
	211-U Tank Farm		
Pump pits	Rain water collected in pits and pipe trenches.	*	*
	Sanitary water from area flushing, safety shower drain and eye washer drain.	*	*
Nitric Acid load-out spot	Rain water collected the load-out spot.	*	*
	Raw water used in area flushing.	*	*
	Sanitary water from safety shower and eye washer.	*	*
	KOH Truck Spot		
Sump	Rain water collected in sump.	*	*
	Sanitary water from area flushing, safety shower drain and eye washer drain.	*	*

9 3 1 5 0 5 6 7 1 1 9

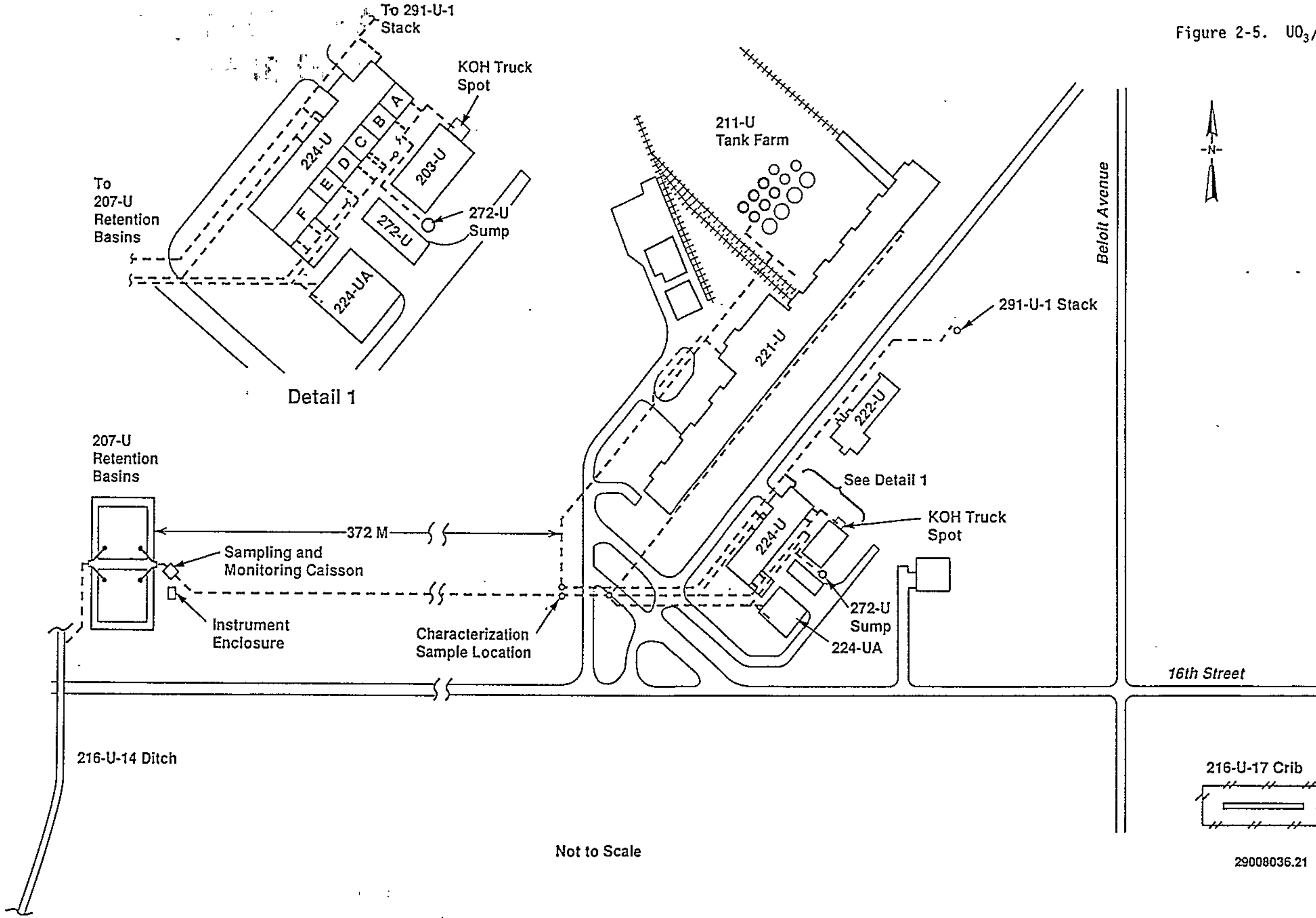
Table 2-1. Contributors to UO_3/U Plant Wastewater Stream. (sheet 7 of 7)

Contributor area/vessel	Source/usage	Typical Flow (L/min) Calcin+	Standby
Retired Facilities			
222-U, 271-U, 221-U HVAC	Steam condensate from building heating.	*	*
	Raw water used in building cooling.	*	*
222-U, 271-U, 221-U cold-side floor drains	Sanitary water from floor flushing.	*	*
291-U-1 stack	Precipitation and condensate from 221-U canyon exhaust.	*	*

*Flow from the source is expected but flow data are not available.
+Calcin - calcination (plant operation) mode.

This page intentionally left blank.

Figure 2-5. UO_3/U Plant Wastewater Routing.



THIS PAGE INTENTIONALLY
LEFT BLANK

The flow measurement for individual contributors listed in Table 2-1 is difficult because of inaccessibility and flowrate fluctuation for a number of the contributors. The flowrate information is available for the major contributors. This information is given in Table 2-1 for both calcination mode and standby mode.

In view of Table 2-1, the contributors can be categorized as follows; each of the categories will be discussed in more detail in Section 2.4.

- Raw water
- Steam condensate
- Sanitary water
- Rain water
- Moisture condensation from air.

All contributions from the various locations are combined and eventually merged into a 24-in. main header which discharges into the 207-U Retention Basins and then to the 216-U-14 Ditch. The UO_3/U Plant wastewater flow diagrams are shown in Figure 2-6.

The 207-U Retention Basins consist of two sections, the north basin and the south basin; each has 550,000 gal of capacity. A weir on the separation wall between the two basins allows one basin to overflow to the other. Inlet and outlet manual valves are provided for each basin. In the event of contamination, the content of the affected basin can be manually isolated while diverting the wastewater flow to the alternate basin. However, the 207-U capacity is insufficient for use as a long-term quarantine basin. Frequent sampling is performed during calcination mode to trend radioactivity levels in the stream. In the event radioactivity levels exceed internal control limits, operations are curtailed or ceased until the contamination can be mitigated. Since any response involving 207-U valvings must be manually implemented, the need to provide remote valve control is being evaluated.

Equipment for pH monitoring and flow-proportional sampling is provided for the combined discharge just upstream of the 207-U Retention Basins. These instruments are contained in a caisson and an enclosure which are located 3- to 4.5-m upstream of the inlet to 207-U (see Figure 2-5). Each of two independent pH monitoring and alarm systems consists of a probe, a transmitter, and a recorder (which is located in the control room of the 224-U Building). The pH of this stream is recorded continuously. The pH instruments are calibrated monthly with pH 2, 4, 7, 10, and 12 buffers. Alarms, which are also located in the control room, are activated when the stream pH exceeds 10 or drops below 4. In the event an alarm sounds, immediate action is taken to prevent the pH of this wastestream from going outside the legal limit of 2 to 12.5.

9 1 1 1 1 9 5 0 6 7 3

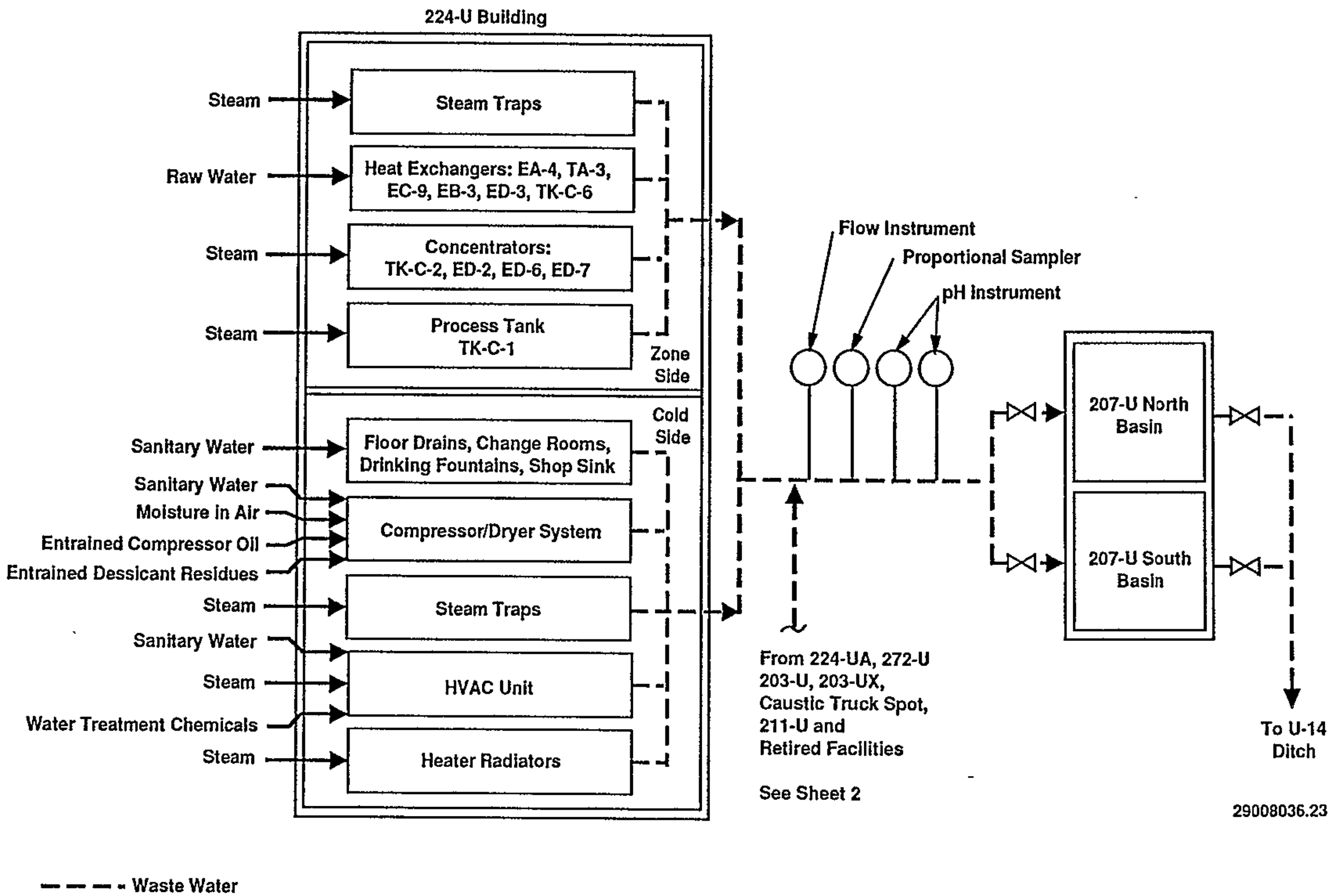


Figure 2-6. UO_3/U Wastewater Flow Diagram. (sheet 1 of 2)

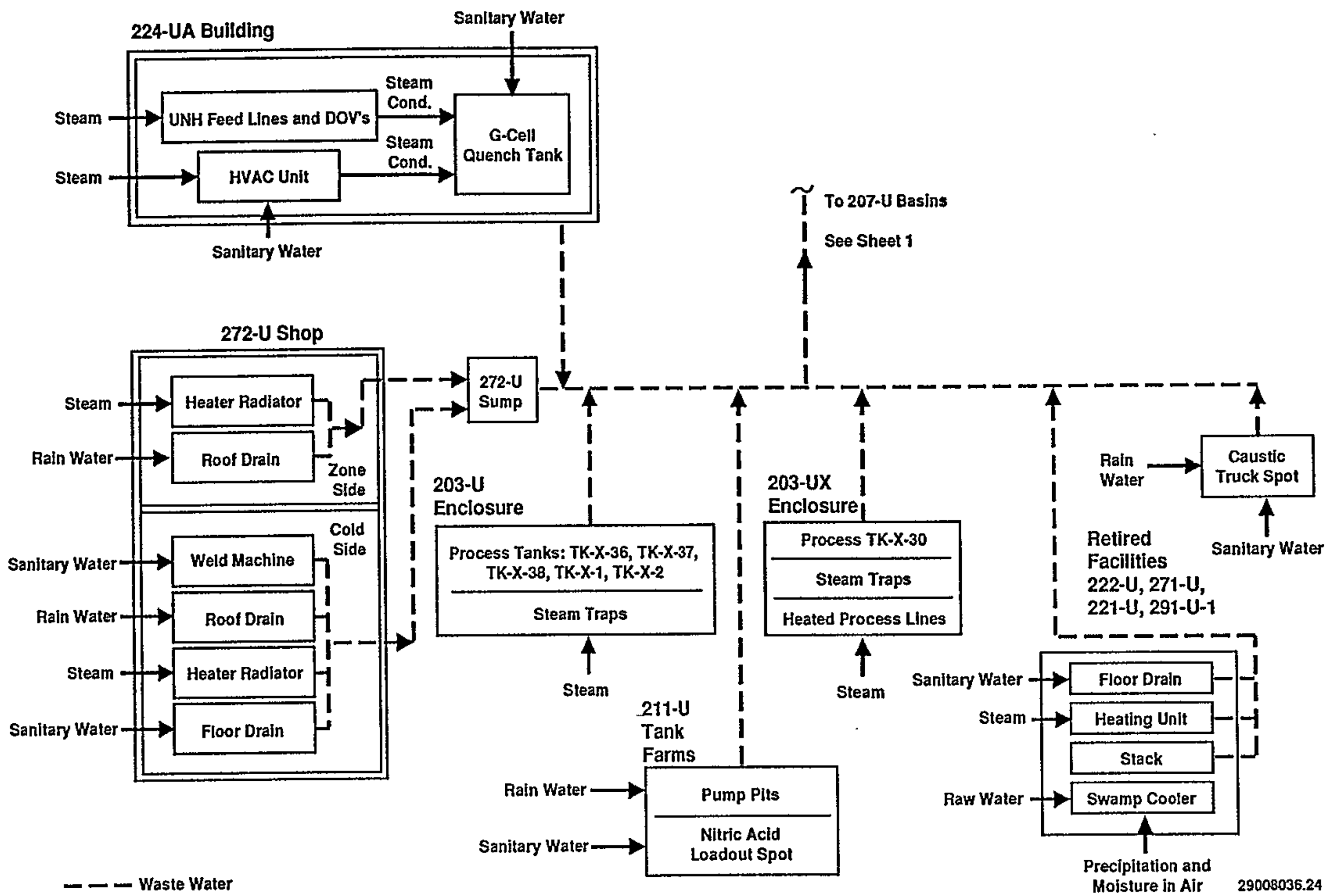


Figure 2-6. UO_3/U Wastewater Flow Diagram. (sheet 2 of 2)

The flow-proportional sampling system collects composite samples from the combined UO_3/U Plant Wastewater stream. Flowrate recorder and flow totalizer equipment are also provided. The operator obtains weekly composite samples from the sampler along with the flow totalizer reading. This information is used by the Environmental Laboratory to make monthly composite samples. Analyses are made on the samples to ensure compliance with the applicable release limits. In addition to the "environmental" samples, "process" samples are taken weekly to analyze for radioactivity, uranium, and pH for the purpose of ensuring early detection of any process or system upset in the plant.

Currently there is no continuous monitoring for radioactivity for the wastewater stream. Since the radioactive content of this stream is routinely near the laboratory detection limits, no feasible on-line radioactivity monitor has been identified for this stream. An engineering study has been initiated to determine other alternatives in detecting process vessel failure that could potentially introduce radioactivity into the wastewater stream.

2.3 PROCESS DESCRIPTIONS

The UO_3 Plant has two principal operating modes. Currently, the plant is in standby, awaiting receipt of UNH feedstock from PUREX. When sufficient feedstock is on hand, the UO_3 Plant enters a UNH calcination mode to produce UO_3 powder. These processing activities are described in more detail below. The plant puts out wastewater to the 207-U Retention Basins and 216-U-14 Ditch whether it is in the UNH calcination mode or in standby mode. When in UNH calcination mode, the flowrate is about 3,000 to 3,800 L/min; in standby mode, the flowrate is reduced to about 380 to 760 L/min.

2.3.1 Present Activities

Presently, the UO_3 Plant is in standby mode. In addition, the uranium recycle concentrator (TK C-2) has been out of service for repairs since November 1989. Without the concentrator operating, there is no steam condensate contribution from TK C-2 coil and no cooling water contribution from the EB-3 and ED-3 condensers, which would be operated in conjunction with TK C-2. The total monthly volumes of discharge are given in Table 2-2 for the period from October 1989 to March 1990.

Table 2-2. Monthly Volumes of Discharge from October 1989 to March 1990 for UO_3/U Plant Wastewater.

Month	Discharge (L/mo)
October 1989	2.30 E+07
November 1989	2.10 E+07
December 1989	2.70 E+07
January 1990	1.84 E+07
February 1990	1.86 E+07
March 1990	2.64 E+07

2.3.2 Past Activities

Since restart in 1984, the UO_3 Plant has alternated between calcination and standby operating modes, as needed to process UNH from PUREX. These modes will be described in more detail below.

2.3.2.1 Calcination Mode Process Activities. In calcination mode, virtually all process systems at UO_3 Plant are in continuous operation to convert UNH from PUREX into UO_3 powder. Other operations performed at UO_3 Plant in support of this mission include:

- Scrubbing of UNH calcination offgas with 10 Molar recovered nitric acid to dissolve entrained UO_3 and second-stage acid absorption treatment with process condensate to recover nitric acid for reuse at PUREX
- Collecting and concentrating various uranium-bearing rinse, flush, and decontamination solutions for shipment to PUREX and subsequent uranium recovery at that facility
- Handling and disposing gaseous, liquid, and solid wastes.

These operations are shown schematically in Figure 2-7.

The process depicted in this figure begins with the transport of UNH from PUREX. Uranium product, as 2.1 Molar or 60% UNH, is transported to the UO_3 Plant on a batch basis contained in a 2,800-gal tank trailer via the Hanford Site highway system. The UNH solution is pumped from the tank trailer at the UNH Truck Spot to Tank C-1 in C-Cell. The solution is sampled for accountability and observed for the presence of a visible organic layer. In the event an organic layer is observed, the UNH solution is returned to PUREX for rework. The UNH accepted for processing is pumped to, and stored in, two 100,000-gal storage tanks (X-1 and X-2) located in the 203-U enclosure.

After sufficient UNH inventory has been accumulated in the storage facilities at the PUREX and UO_3 Plants, concentration of the UNH is started. The UNH solution is pumped from the 203-U area to concentrators in D-cell. The solution is concentrated from a uranium content of 2.1 Molar (60% UNH) to 5.5 Molar (100% UNH) by thermal boiling in the steam-heated concentrators (ED-2, ED-6, and ED-7). The concentrated UNH, routed to the 203-UX area, is stored in a steam-heated tank (X-30) to prevent freezing of the concentrated solution.

Offgas from the concentrator overheads knockout pot is routed through a catch tank to a condenser (ED-3). Water and a small amount of nitric acid vapors evolved during concentration are condensed and collected in a condensate tank. A portion of the condensate is used as reflux water in the acid absorber tower (TA-3); the balance is neutralized and discarded to the 216-U-17 Crib as waste. The reflux water to TA-3 is passed through a reflux water cooler (EC-9) where the reflux water temperature is brought down to

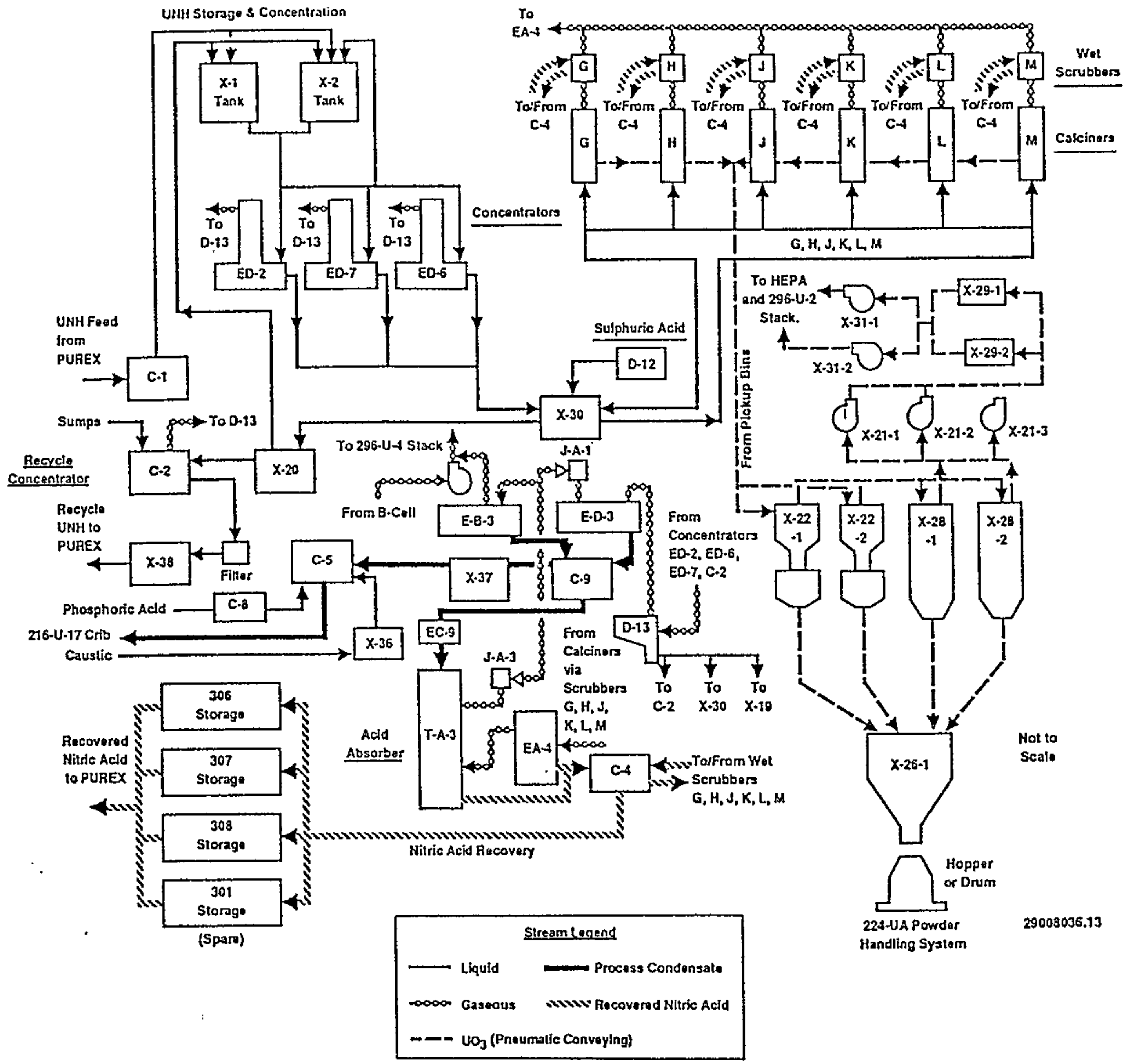


Figure 2-7. UO_3 Process Flow Diagram.

improve its absorption efficiency. The major vessels involved in the neutralization system are Tk X-37, the process condensate storage tank Tk X-36; the potassium hydroxide storage tank; and Tk C-5, the elementary neutralization tank.

Concentrated UNH stored in the 203-UX area is butted with a small amount of 17 Molar (93%) sulfuric acid. Sulfuric acid is added because sulfur in the powder product aids further processing of the uranium at the Feed Materials Production Center in Fernald, Ohio.

Concentrated UNH is filtered and pumped to the 224-UA Building where the calcination process is conducted. Conversion of UNH to UO_3 powder occurs by thermal decomposition in six electrically heated continuously agitated trough calciners. The UNH feed is supplied to the calciners from a pressurized, electrically heat-traced recirculation loop.

Before operations, the calciners are filled with UO_3 bed powder and the electric furnaces are turned on. The furnaces are operated over a 30-hour period to bring the calciner shell temperature to 400 °C. This time period is necessary to minimize warpage of the calciner shell. As the temperature reaches 400 °C, UNH is introduced into the calciners through four feed points. This initial feed introduction reduces the calciner temperature. The UNH feed to the calciner is temperature controlled such that the calciner bed operates at 270 °C, while the shell temperature is incrementally increased to about 500 °C for optimal processing efficiency. The UNH feed temperature control is accomplished by running the feed lines and valves through a steam-heated enclosure, called a "hot box." Additional temperature control is done by steam "cooling" the individual feed points to prevent premature calcination of the UNH.

When UNH contacts the heated bed powder, the conversion to UO_3 is almost instantaneous. This UO_3 coats the bed powder to form larger spherical particles. The resulting accumulation overflows a weir at one end of the calciner.

The rapid decomposition of UNH liberates quantities of water vapor, oxygen, and oxides of nitrogen. This offgas is scrubbed with nitric acid in the wet scrubbers to dissolve UO_3 fines and then is routed through a gas cooler (EA-4) and on to the acid absorber tower (TA-3). Suction vacuum for this system is provided by steam jets on the 224-U roof. As the offgas bubbles rise through bubble cap trays in the tower, nitric acid is formed. This acid, approximately 10.4 Molar (50%), is drained to Tk C-4. The remaining gas is passed through a condenser (EB-3) prior to discharge of noncondensibles to the environment via the 80-ft 296-U-4 stack.

The majority of the recovered nitric acid in Tk C-4 is pumped to the nitric acid storage tanks (Tk-306, Tk-307 and Tk-308) at the 211-U Tank Farm. A portion of the nitric acid from Tk C-4 is pumped to the wet scrubbers to dissolve UO_3 powder from the calciner offgas. The nitric acid leaving the wet scrubbers is cooled in an acid cooler (Tk C-6) then drained back to Tk C-4.

The UO_3 powder from the calciner falls into a pickup bin. This product is conveyed pneumatically to the powder handling tower where the powder and air are separated by a cyclone separator. The exhaust air from this operation is routed through primary and secondary bag filters, a prefilter, and high-efficiency particulate air (HEPA) filter before discharge to the environment via the 296-U-2 stack. Powder from the cyclone and primary bag filter is collected in the powder hopper. Powder from the secondary bag filter is collected in 30-gal drums. There are two parallel trains of cyclones and bag filters; when one is in operation, the other is in standby.

The UO_3 in the powder hopper discharges into shipping containers in the powder loadout room. Filled containers called T hoppers contain about 4.6 MTU (metric tons of uranium) each of UO_3 and are stored on a concrete pad in a fenced area north of the 2714-U Building. Powder is shipped off-site from this area via specially equipped railcars. Small amounts of powder collected from the secondary bag filters are collected in 30-gal drums and then put back into the powder handling system.

Room air from the loadout enclosure in the loadout room is passed through a prefilter and HEPA filter, sampled for radioactive particulates, and monitored before discharge to the environment, via the 296-U-13 stack.

When the plant is in UNH calcination mode, about 85% of the wastewater flow comes from operating the heat exchangers EB-3, ED-3, Tk C-6, EA-4, and cooling the acid absorber TA-3. The majority of the remaining contribution comes from operating the concentrators ED-2, ED-6, ED-7, and Tk C-2.

2.3.2.2 Standby Operating Mode. During standby, activities are focused on preparing the UO_3 Plant for the next calcination mode operation. Equipment is flushed, decontaminated, and repaired. The TK-C-2 recycle concentrator operates as needed to concentrate flush solutions, rainwater, and any other solutions which find their way into the 203-U, 203-UX, 224-UA, Backpad, and 224-U cell drain system sumps. The contents of the recycle concentrator are filtered and stored in TK-X-38 for shipment to PUREX when necessary to assure adequate capacity during calcination mode. Recovered nitric acid is shipped to PUREX when needed at that facility. UNH feed solution is shipped from PUREX to UO_3 Plant as available in preparation for the next calcination mode operating period.

The ED-3 condenser is operated to remove the condensibles from the Tk C-2 boil-off process. The EB-3 condenser is operated as part of the vessel vent system. When the plant is in standby mode, about 60 to 70% of the wastewater flow comes from operating the heat exchangers EB-3 and ED-3.

2.3.3 Future Process Activities

For the next few years, the UO_3 Plant will continue to alternate between calcination mode and standby mode according to the availability of UNH feedstocks from the PUREX Plant.

An upgrade has been initiated to isolate the nitric acid tank car loadout spot located at 211-U area from the wastewater stream. Currently the drain from the sump is discharged directly into the wastewater stream. Even though alarms, automatic shutoff features, and automatic transfer line vent valves are installed for the nitric acid loadout system, the potential still exists for the acid to enter the wastewater stream from the loadout operation. The isolation upgrade will eliminate such potential.

Another engineering study which recommends diking and isolating the wastewater stream from the recovered acid tanks in the 211-U area will be implemented. In the event that a catastrophic failure of the nitric acid storage tank(s) should occur, the acid could enter the wastewater stream through the abandoned pump pit nearby. An engineering project for building a dike around the nitric acid storage tanks has been initiated and is targeted for completion in October 1994.

The shutdown and terminal cleanout of the UO_3 Plant is expected to occur in the next 5 to 10 years. During the terminal cleanout, the stream flow and composition for the wastewater will be similar to that for the current standby condition.

2.4 PROCESS DATA

The constituents of each category of contributors to the UO_3/U Plant wastewater stream identified in Section 2.2 will be discussed below. It should be noted that whether the plant is in calcination mode or standby mode, the concentrations of the constituents are not expected to change. This is due to the fact that none of the contributing sources comes directly in contact with the process fluids.

2.4.1 Raw Water

The raw water sources comprise the majority of the contribution to the wastewater stream. The raw water, supplied from the 284-W Powerhouse, is used in process heat exchangers such as condensers and coolers. The raw water going to the wastewater stream is not expected to be radioactively contaminated with radiation from the contributors.

2.4.2 Steam Condensate

Steam condensate contributing to the wastewater stream comes from steam usage for tank heating, concentrator operation, pipe and equipment heating, building heating, and steam line steam trap drains. The steam used at UO_3 Plant is supplied from the 284-W Powerhouse.

2.4.3 Sanitary Water

Sanitary water contributing to the wastewater stream is used for safety showers, eye washers, G cell steam condensate quench tank, changeroom showers, instrument shop sink drain, floor flushing, and equipment cooling. The sanitary water used at UO_3 Plant is supplied from the 284-W Powerhouse.

The sanitary water from the spray washer overflow in the 224-U Building HVAC system contains some water treatment chemicals. This treated water does not normally enter the wastewater stream except when it overflows the washer pan caused by reasons such as malfunctioning of the liquid level control. The water treatment chemicals used are Dearcide 717 (or 722), which is a biocide chemical, and Dearborn 922, which is a corrosion inhibitor. Dearcide 717 (or 722) is added to the washer pan at a rate of 8 oz/wk. Dearborn 922 is applied to the washer pan automatically whenever the conductivity in the washer gets above the instrument controller set point. The active ingredient in Dearcide 722 is poly(oxyethylene(dimethyliminio)-ethylene(dimethyliminio)-ethylene dichloride). The main active ingredients in Dearcide 717 are quaternary amine-(n-alkyl dimethyl benzyl ammonium chloride) and bis(tri-n-butyltin)oxide. The main active ingredient in Dearborn 922 is potassium hydroxide.

The sanitary water drained from the KOH truck spot can contain neutralized KOH residue from the caustic transfer process. The caustic residue is collected from the transfer hose and fittings at the end of a caustic load-in process which occurs very infrequently. Only three transfers were made in the past 3 yr.

All drainage from the KOH truck spot is pH checked and neutralized (if necessary) prior to discharging to the wastewater stream. The typical neutralizing agent used is Neutracit, which has citric acid as an active ingredient and bromothymol blue as pH indicator dye. There are two isolation valves installed in series in the drain line to the wastewater stream from the caustic truck spot. These valves are locked in the closed position to prevent any out-of-specification material from entering the wastewater stream.

The sanitary water drained from the P 307-U pump pit at the 211-U area is sampled for uranium, pH, and nitrate prior to discharging to the wastewater stream. The neutralizing agent used at 211-U is typically Neutrasorb. A partial listing of the constituents in Neutrasorb includes sodium carbonate, magnesium oxide, and calcium carbonate. There are two isolation valves installed in series in the drain line from the pump pit to the wastewater stream. These valves are locked in the closed position to prevent any out-of-specification material in the pump pit from entering the wastewater stream. Any material containing uranium beyond environmental release limits would be transported back to the UNH recycle system in the 224-U Building.

Operating procedures are in place for the quarantine/release process described above for the caustic truck spot and P 307-U pump pit.

2.4.4 Rain Water

Rain water entering the wastewater stream is collected from some outdoor sump drains, the 291-U-1 stack, and the 272-U roof drain.

The rain water collected in the P 307-U pump pit at 211-U could contain the residue of the recovered nitric acid. The quarantine/release process for the pit content is described in Section 2.4.3.

The rain water drained from the KOH truck spot is checked for pH prior to discharging to the wastewater stream. The quarantine/release process is described in Section 2.4.3.

The rain water from the 272-U roof is collected in the 272-U sump adjacent to the 272-U Building. The sump transfer is activated automatically by a liquid level control device. When the sump content reaches the set point of the level control, the sump pump is activated to transfer the content to the wastewater stream. The sump content is sampled weekly for uranium, radioactivity, pH, and nitrate. Operating procedures are in place to call out the sampling requirement. All sample results for the 272-U sump have met environmental discharge limits.

2.4.5 Moisture Condensed From Air

Air condensate entering the wastewater stream comes from the compressor/dryer system and 291-U-1 stack. Only trace amounts of the condensate come from 291-U-1 stack. However, the condensate flow from the compressed air system could be as high as 45 L/d depending on the season.

The condensate from the compressed air system contains trace amounts of entrained compressor oil and desiccant residues. The compressor oil used at UO_3 Plant is a synthetic oil (Sullube 32). The desiccant used in the dryer is Super Bead desiccant or Super Dry Tablets. The main ingredient for Super Bead Desiccant is potassium carbonate; the main ingredient for Super Dry tablets is sodium nitrate.

2.5 ADMINISTRATIVE CONTROLS

Administrative controls have been imposed to meet the requirements, intent, and spirit of all applicable federal, state, and local environmental laws, regulations, and standards. A program of regulatory compliance has been developed based on environmental laws and input from regulatory agencies.

2.5.1 UO_3/U Plant Wastewater Management

Since current technology does not exist for on-line (real-time) monitoring for all regulated materials, the UO_3 Plant management has incorporated administrative controls to regulate discharges to the UO_3/U Plant Wastewater.

2.5.1.1 General Requirements. The administrative controls are based on general requirements that apply to all activities associated with regualted materials.

Training is fundamental to the implementation of administrative controls. General training courses are given to all employees, and specific training is given to employees who work with regulated materials or in areas where they may come into contact with them. This training program includes annual refresher training. A "tickler system" is used at UO_3 Plant to minimize the potential for employees to become delinquent in training requirements.

An additional general requirement that provides an important control consists of frequent surveillances and inspections. Surveillances and inspections increase the likelihood that a spill or leak would be detected in a timely manner. These are conducted on a regular basis and are supplemented with random surveillances.

2.5.1.2 Specific Requirements. Administrative controls are in place for assuring that no materials regualted by Ecology, the EPA, and the DOE are purposely released into Hanford soil columns. To prevent improper discharge to the UO_3/U Plant Wastewater, the following approach is taken:

- Disposal of dangerous waste is controlled to prevent improper disposal of wastes to any sumps, sinks, or drains which are routed to the 207-U Retention Basins. This is accomplished by mandating that all wastes of a chemical nature are dispositioned through the chemical waste disposal system. This methodology is incorporated to ensure that all chemical waste designations are performed by Solid Waste Engineering (SWE) and all designated wastes are properly staged, packaged, and transported from the facility in accordance with applicable laws. Company manuals are available at the facility to provide guidance on waste management.

- Briefings are given to plant employees on a regular basis by the Plant Environmental Engineer. The purpose of these talks is to reiterate the importance of environmental compliance. Employees are reminded of their responsibilities with respect to individual waste-generating activities and consequences of noncompliance are conveyed.

2.5.2 Diligent Search

As a check for effectiveness of administrative controls, a diligent search was performed. This consisted of an inspection of the UO_3 Plant for materials or activities that have a direct bearing on the environmental compliance of the facility. The facility search encompassed review of documentation and inspection of operating activities for product and waste handling. This was done to assure than an accurate proposed designation of the UO_3/U Plant Wastewater could be presented in this report.

Documentation reviewed included Material Safety Data Sheets (MSDS), *Superfund Amendments and Reauthorization Act of 1986* (SARA) 312 inventory reports, dangerous waste shipping reports (manifests), spill reports, and facility procedures. The inspection included discussions with facility staff on chemical waste disposal practices.

This effort and its relation to the potential for disposal of chemical products to the UO_3/U Plant Wastewater is incorporated in the Section 5.3 discussion.

This page intentionally left blank.

3.0 SAMPLE DATA

This section reports and summarizes the sample results for the UO_3/U Plant Wastewater stream. There are two data sets provided: waste stream sampling data and background data.

3.1 DATA SOURCE

The wastestream sampling data, which identify both chemical and radiological constituents during standby mode, consist of four samples taken during the period from October 1989 through March 1990. These data are reported in Appendix A. Since the facility has not been in a processing mode since May 1989, "new data" are not available for periods of plant operation. Additionally, all data taken in support of WHC-EP-0287, *Waste Stream Characterization Report* (WHC 1989), are provided in Appendix B. The data used to evaluate the stream for designation are from the period October 1989 through March 1990 ("new data").

The background data consist of samples taken of the raw water supply from the Columbia River. This information is provided in Table 3-1.

3.1.1 Wastestream Sampling Data

The wastestream sampling data consists of two separate sets: (1) the chemical data set and (2) the radiological data set. Both data sets are reported in Appendix A.

3.1.1.1 Chemical. The chemical data set consists of four samples that were taken over a 4-mo period at a manhole located approximately 53 m southwest of Building 221-U (see Figure 2-5). This sample point is downstream of all contributors. The four samples (December 1, 1989; March 2, 1990; March 14, 1990; March 22, 1990) were all taken with the plant in standby mode.

The sampling procedure called for representative sampling in accordance with SW-846 (EPA 1986) sampling and analytical protocol. This protocol requires that a sufficient number of samples be collected in a random manner over a sufficient period of time to characterize the variability or uniformity of the stream. This was done by taking grab samples on a partitioned time-random basis. The sampling was randomized by splitting the workdays of the month to be sampled into two 4-h time periods and choosing one of these time periods by using a random number generator. All samples were taken to a Contract Laboratory in Richland, Washington, for analysis. The specific details of the sampling and analytical procedures used are contained in the "parent" document for the *Hanford Site Stream-Specific Reports* (WHC-EP-0342). The error introduced by chemical analysis is not specifically addressed in this report.

3.1.1.2 Radiological. The radiological data set consists of samples taken at the same location on the same dates as mentioned in Section 3.1.1.1. The error introduced by radionuclide analysis is not specifically addressed in this report.

3.1.2 Background Data

Information on the impurity content of incoming water supplies to UO_3 Plant was used in conjunction with other data in an effort to identify background constituents existing in the stream prior to use at the facility. These data were not used in calculations of corrected concentrations for waste designation purposes. However, in situations where process knowledge reveals no identifiable source, this information, in conjunction with sample blank data, may prove useful in tracking down the most plausible source of a contaminant (see Table 3-1).

3.2 DATA PRESENTATION

The following three-step approach has been taken in determining which constituents are present in the UO_3/U Plant wastewater: (1) identify constituents of concern, (2) specify which of these constituents have been detected, and (3) present the data in a statistical summary format.

Over 40,000 chemical analytes were of interest in the analyses. The bulk of these analytes were compiled from a combined mass spectral library from the EPA, the National Institute of Occupational Safety and Health, and the National Bureau of Standards. This library is composed of mass spectra for various chemical constituents, each with a unique "signature" that can be identified by gas chromatograph/mass spectrometer analysis.

Procedural Liquid Effluent Analytical Data (LEAD) and Chain of Custody reference numbers associated with the UO_3/U Plant Wastewater samples are identified in Table 3-2. (Twenty-two unique chemical constituents were identified in the stream as being at or above the Contract Laboratory contract detection limits, refer to WHC-EP-0287, Volume 3, for detection limits [WHC 1989].) These data can be found in Table 3-3 in a statistical summary format.

Table 3-1. Summary of 200 West Area Raw Water and Sanitary Data (1985-1989). (sheet 1 of 3)

Constituent/Parameter [all ppb, exceptions noted]	Raw Water[a] (1986-1987)			Sanitary Water[b] (1985-1988)			2724-W Laundry Sanitary Water[c] (1989)		
	N[d]	AVG	STD DEV	N	AVG	STD DEV	N	AVG	STD DEV
Alkalinity (Method B)				4	5.45E+04	5.78E+02			
Aluminum	5	1.78E+02	6.31E+01						
Arsenic				4	<5.00E+00	NA			
Arsenic (EP Toxic)							4	<5.00E+02	NA
Barium	5	2.94E+01	1.52E+00	4	*1.15E+02	1.91E+01	4	2.90E+01	1.41E+00
Barium (EP Toxic)							4	<1.00E+03	NA
Boron							4	1.77E+01	1.00E+01
Cadmium				4	<5.00E-01	NA			
Cadmium (EP Toxic)							4	<1.00E+02	NA
Calcium	5	1.76E+04	2.71E+03				4	1.87E+04	2.94E+02
Chromium				4	<1.00E+01	NA			
Chromium (EP Toxic)							4	<5.00E+02	NA
Chloride	5	8.25E+02	1.99E+02	4	2.35E+03	8.66E+02	4	2.92E+03	1.71E+02
Conductivity-field (µS)	5	9.40E+01	4.65E+01				4	1.45E+02	1.60E+01
Copper	5	1.52E+01	7.96E+00	4	<5.00E+01	NA			
Color (units)				4	*6.25E+00	2.50E+00			
Ignitability (deg F)							4	2.11E+02	2.00E+00
Iron	5	1.14E+02	1.44E+02	4	*2.50E+02	2.68E+02	4	3.27E+01	3.40E+00
Fluoride	1	9.30E+01	NA	4	*1.08E+02	1.50E+01	4	1.28E+02	8.68E+00
Lead	3	8.13E+00	5.42E+00	4	<5.00E+00	NA			
Lead (EP Toxic)							4	<5.00E+02	NA
Magnesium	5	4.12E+03	5.41E+02				4	4.35E+03	1.59E+02
Manganese	5	1.68E+01	1.99E+01	4	<1.00E+01	NA			
Mercury				4	<5.00E-01	NA			
Mercury (EP Toxic)							4	<2.00E+01	NA
Nitrate (as N)				4	*8.50E+01	4.12E+01	4	5.00E+02	0.00E+00
pH (dimensionless)	5	6.52E+00	1.04E+00				4	7.10E+00	3.40E-01
Potassium	5	7.88E+02	4.25E+01				4	7.28E+02	5.44E+01
Reactivity Cyanide (mg/kg)							4	<1.00E+02	NA
Reactivity Sulfide (mg/kg)							4	<1.00E+02	NA
Selenium				4	<5.00E+00	NA			
Selenium (EP Toxic)							4	<5.00E+02	NA
Silicon							4	2.14E+03	1.02E+01
Silver				4	<1.00E+01	NA	4	1.00E+01	0.00E+00
Silver (EP Toxic)							4	<5.00E+02	NA

Table 3-1. Summary of 200 West Area Raw Water and Sanitary Data (1985-1989). (sheet 2 of 3)

Constituent/Parameter [all ppb, exceptions noted]	Raw Water[a] (1986-1987) N[d]	AVG	STD DEV	Sanitary Water[b] (1985-1988) N	AVG	STD DEV	2724-W Laundry Sanitary Water[c] (1989) N	AVG	STD DEV
Sodium	5	2.23E+03	9.28E+01	4	2.20E+03	1.15E+02	4	2.05E+03	1.28E+02
Strontium							4	9.47E+01	3.00E+00
Sulfate	5	9.83E+03	1.40E+03	4	1.47E+04	1.16E+03	4	1.40E+04	4.44E+02
Sulfide	5	1.00E+03	8.63E-05		-				
Temperature-field (C)	5	1.48E+01	6.80E+00				4	1.31E+01	7.40E+00
Total Carbon (µg/g)							4	1.51E+04	1.71E+02
TOC (µg/g)	5	1.61E+03	4.76E+02						
TOX (µg (Cl)/L)	4	1.44E+01	8.30E+00				4	1.42E+02	1.30E+01
TDS (mg/L)				4	7.95E+01	1.28E+01	4	5.37E+04	3.06E+04
Trichloromethane							4	2.82E+01	7.94E+00
Uranium	5	5.21E-01	1.80E-01				3	2.54E-01	9.46E-02
Zinc	5	7.60E+00	8.94E-01	4	*1.03E+02	4.50E+01	4	5.85E+01	3.12E+01
Alpha Activity	5	2.34E+00	3.49E+00						
Beta Activity	5	1.05E+01	1.47E+01				3	4.33E+00	3.86E+00

NOTES: Averages denoted by an asterisk include a mix of above- and below-detection limit in computations when the actual values are below the detection limit.

See companion table for inorganic detection limits as compiled from Hanford Environmental Health Foundation.

[a]Compiled from "Substance Toxicity Evaluation of Waste Data Base" provided by F. M. Jungfleisch (this data is an update of the data presented in WHC 1988, *Preliminary Evaluation of Hanford Liquid Discharges*), Westinghouse Hanford Company, Richland, Washington.

[b]Compiled from HEHF, 1986, *Hanford Sanitary Water Quality Surveillance, CY 1985*, HEHF-55, Hanford Environmental Health Foundation, Environmental Health Sciences, Richland, Washington; HEHF-59; HEHF-71; and HEHF-74 (corresponding reports for CY 1986, 1987, and 1988).

[c]Data are from sampling campaign conducted October 1, 1989, to March 30, 1990, in support of Stream Specific Reports. These data are considered representative of UO_3 Plant sanitary water due to the close proximity of the Laundry Facility to the UO_3 Plant.

[d]N is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets.

ppb = parts per billion.
TOC = total organic carbon.
TOX = total organic halides.
µS = microSiemen.
µg = microgram.

Table 3-1. Summary of 200 West Area Raw Water and Sanitary Data (1985-1989). (sheet 3 of 3)

Constituent/Parameter [all ppb, exceptions noted]	200 East[b]		
	N[c]	AVG	STD DEV
1,1,1-Trichloroethane	1	<DL[c]	NA
1,1 Dichloroethylene	1	<DL	NA
1,2,-Dichloroethane	1	<DL	NA
1,3,5-Trimethylbenzene	1	<DL	NA
Benzene	1	<DL	NA
Bromodichloromethane	5	1.76E+00	6.68E-01
Bromoform	5	<DL	NA
Carbon Tetrachloride	1	<DL	NA
Chlorodibromomethane	5	<DL	NA
Chloroform	5	2.65E+01	1.27E+01
Difluorodichloromethane	2	<DL	NA
Ethlylbenzene	1	<DL	NA
o-Xylene	1	<DL	NA
p-Chlorotoluene	1	<DL	NA
p-Dichlorobenzene	1	<DL	NA
Tetrachloroethylene	1	<DL	NA
Toluene	1	<DL	NA
Trichloroethylene	1	<DL	NA
Vinyl Chloride	1	<DL	NA

[a]The data given in this table were compiled by Hanford Environmental Health Foundation (HEHF). Data sets included first quarter 1987 and quarterly 1988 data. The total trihalomethane concentration for the 200 and 300 Areas appear in the HEHF, 1989, *Hanford Water Quality Surveillance Report for CY 1988*, HEHF-74, HEHF, Environmental Health Sciences, Richland, Washington, and the *Hanford Water Quality Surveillance Report for CY 1989*.

[b]N is defined as the number of test results available for a particular analyte; N may reflect both single and multiple data sets. For N = 1 the sole available data entry is listed as "avg."

[c]See companion table for organic detection limits as compiled from HEHF data.

DL = detection limit
pbb = parts per billion.

Table 3-2. Procedures for UO_3/U Plant Wastewater Samples. (sheet 1 of 2)

LEAD#	50822	51000	51048	51083
C of C#	50822	51000	51048	51083
Alkalinity	X	X	X	X
Alpha counting	X	X	X	X
^{241}Americium	X	X		
Ammonia	X	X	X	X
Arsenic	X	X	X	X
Atomic emission spectroscopy	X	X	X	X
Beta counting	X		X	X
^{14}Carbon		X	X	X
Conductivity-field	X	X	X	X
Curium isotopes	X		X	
Cyanide	X	X	X	X
Direct aqueous injection (GC)	X	X	X	X
Fluoride (LDL)	X	X	X	X
Gamma energy analysis	X	X	X	X
Hydrazine	X	X	X	X
Ion chromatography	X	X	X	X
Lead	X	X	X	X
Low-energy photon detection		X	X	
Mercury	X	X	X	X
pH-field	X	X	X	X
Plutonium isotopes		X	X	X
Selenium	X	X	X	X
Semivolatile organics (GC/MS)	X	X	X	X
Strontium beta counting	X		X	X
Sulfide	X	X	X	X
Suspended solids	X	X	X	X
Temperature-field	X	X	X	X
Thallium	X	X	X	X
Total carbon	X	X	X	X
Total dissolved solids	X	X	X	X
Total organic carbon	X	X	X	X
Total organic halides (LDL)	X	X	X	X
Total radium alpha counting	X	X	X	X
Tritium		X	X	X
Uranium	X	X	X	X
Uranium isotopes	X	X	X	X
Volatile organics (GC/MS)	X	X	X	X
LEAD#	50822B	51000B	51048B	51083B
C of C#	50823	51001	51049	51084
Volatile organics (GC/MS)	X	X	X	X
LEAD#	50822T	51000T	51048T	51083T
C of C#	50824	51002	51050	51085
Volatile organics (GC/MS)	X	X	X	X

Table 3-2. Procedures for UO_3/U Plant Wastewater Samples. (sheet 2 of 2)

LEAD#	50822E	51000E	51048E	51083E
C of C#	50825	51003	51051	51086
Atomic emission spectroscopy	X	X	X	X
Ignitability	X	X	X	X
Mercury (mixed matrix)	X	X	X	X
Reactive cyanide	X	X	X	X
Reactive sulfide	X	X	X	

NOTES:

Procedures that were performed for a given sample are identified by an "X". Procedure references appear with the data.

LEAD# is the Liquid Effluent Analytical Data number that appears in the data reports. C of C # is the chain-of-custody number.

Abbreviations:

gas chromatography (GC)
low-detection limit (LDL)
mass spectrometry (MS)

Table 3-3. Statistics for UO_3/U Plant Wastewater. (sheet 1 of 2)

Constituent	N	MDA	Method	Mean	StdErr	90%CILim	Maximum
Arsenic (EP Toxic)	4	4	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Barium	4	0	n/a	2.92E+01	4.79E-01	3.00E+01	3.00E+01
Barium (EP Toxic)	4	4	n/a	<1.00E+03	0.00E+00	<1.00E+03	<1.00E+03
Boron	4	0	n/a	1.95E+01	5.52E+00	2.85E+01	3.30E+01
Cadmium (EP Toxic)	4	4	n/a	<1.00E+02	0.00E+00	<1.00E+02	<1.00E+02
Calcium	4	0	n/a	1.79E+04	1.08E+02	1.81E+04	1.82E+04
Chloride	4	0	n/a	9.30E+02	2.38E+01	9.69E+02	1.00E+03
Chromium (EP Toxic)	4	4	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Copper	4	1	DL	1.87E+01	4.85E+00	2.67E+01	3.10E+01
Fluoride	4	0	n/a	1.29E+02	4.71E+00	1.37E+02	1.38E+02
Iron	4	3	DL	3.12E+01	1.25E+00	3.33E+01	3.50E+01
Lead (EP Toxic)	4	4	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Magnesium	4	0	n/a	4.31E+03	1.41E+02	4.54E+03	4.55E+03
Mercury (EP Toxic)	4	4	n/a	<2.00E+01	0.00E+00	<2.00E+01	<2.00E+01
Nitrate	4	2	DL	5.24E+02	2.42E+01	5.64E+02	5.97E+02
Potassium	4	0	n/a	7.16E+02	1.76E+01	7.45E+02	7.52E+02
Selenium (EP Toxic)	4	4	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Silicon	4	0	n/a	2.15E+03	4.21E+01	2.22E+03	2.22E+03
Silver (EP Toxic)	4	4	n/a	<5.00E+02	0.00E+00	<5.00E+02	<5.00E+02
Sodium	4	0	n/a	1.98E+03	5.59E+01	2.07E+03	2.11E+03
Strontium	4	0	n/a	9.42E+01	2.17E+00	9.78E+01	9.80E+01
Sulfate	4	0	n/a	1.00E+04	3.76E+02	1.06E+04	1.06E+04
Thallium	4	3	DL	5.50E+00	5.00E-01	6.32E+00	7.00E+00
Uranium	4	0	n/a	1.32E+00	6.52E-01	2.38E+00	3.27E+00
Zinc	4	2	DL	5.25E+00	2.50E-01	5.66E+00	6.00E+00
Ammonia	4	3	DL	5.32E+01	3.25E+00	5.86E+01	6.30E+01
Alkalinity (Method B)	4	0	n/a	5.72E+04	1.11E+03	5.91E+04	5.90E+04
Alpha Activity (pCi/L)	4	2	DL	1.82E+00	1.10E+00	3.62E+00	5.09E+00
Beta Activity (pCi/L)	3	1	DL	2.20E+00	1.41E-01	2.47E+00	2.37E+00
Conductivity (μS)	4	0	n/a	1.31E+02	3.47E+00	1.36E+02	1.38E+02
Ignitability (°F)	4	0	n/a	2.04E+02	3.40E+00	1.99E+02	1.96E+02
pH (dimensionless)	4	0	n/a	7.02E+00	2.62E-01	6.60E+00	6.25E+00
Reactivity Cyanide (mg/kg)	4	4	n/a	<1.00E+02	0.00E+00	<1.00E+02	<1.00E+02
Reactivity Sulfide (mg/kg)	3	3	n/a	<1.00E+02	4.40E-06	<1.00E+02	<1.00E+02
TDS	4	0	n/a	6.95E+04	3.33E+03	7.50E+04	7.90E+04
Temperature (°C)	4	0	n/a	1.22E+01	1.46E+00	1.46E+01	1.61E+01
TOC	3	1	DL	1.00E+03	5.77E+01	1.11E+03	1.10E+03
Total Carbon	4	0	n/a	1.51E+04	2.36E+02	1.55E+04	1.55E+04
TOX (as Cl)	4	0	n/a	1.22E+01	9.46E-01	1.38E+01	1.50E+01
^{60}Co (pCi/L)	4	2	DL	6.25E-01	3.13E-01	1.14E+00	1.23E+00
$^{239/240}$Pu (pCi/L)	3	2	DL	3.55E-03	1.37E-03	6.13E-03	6.24E-03
^{234}U (pCi/L)	4	0	n/a	6.52E-01	3.13E-01	1.16E+00	1.59E+00
^{235}U (pCi/L)	4	2	DL	5.64E-02	4.48E-02	1.30E-01	1.90E-01
^{238}U (pCi/L)	4	0	n/a	5.08E-01	2.21E-01	8.70E-01	1.17E+00

Table 3-3. Statistics for UO_3/U Plant Wastewater. (sheet 2 of 2)

NOTES:

Mean values, standard errors, confidence interval limits and maxima are in ppb (parts per billion) unless indicated otherwise.

The column headed MDA (Minimum Detectable Amount) is the number of results in each data set below the detection limit.

The column headed Method shows the MDA replacement method used: replacement by the detection limit (DL), replacement of single-valued MDAs by the log-normal plotting position method (LM), or replacement of multiple valued MDAs by the normal plotting position method (MR).

The column headed "90%CILim" (90% Confidence Interval Limit) is the lower limit of the one-tailed 90% confidence interval for all ignitability data sets and pH data sets with mean values below 7.25. For all other data sets it is the upper limit of the one-tailed 90% confidence interval.

The column headed "Maximum" is the minimum value in the data set for ignitability, the value furthest from 7.25 for pH, and the maximum value for all other analytes.

This page intentionally left blank.

4.0 DATA OVERVIEW

This section is provided to present a comparison of stream characterization data that has been obtained through both process knowledge (see Section 2.0) and sampling data (see Section 3.0).

4.1 DATA COMPARISON

Table 4-1 provides a comparison of average stream constituent concentrations to drinking water standards (DWS) for chemical constituents (including plutonium, cobalt, and total alpha activity) and to derived concentration guidelines (DCG) for radioactive constituents. The DWS values are based on maximum contaminant levels (MCL) as stated in Table 4-1. The DCG values do not constitute compliance criteria, but rather are used as screening values for making downstream dose estimates and for best available technology (BAT) assessments. These criteria are not intended to be used here for compliance purposes.

Process knowledge reveals no applications at the UO_3 Plant for any of the hypothetical compounds identified from the analysis of the sampling data. Although hydrogen fluoride was found in the facility in 1987, personnel knew of no application for it in the facility's current configuration; consequently, the material was staged as a dangerous waste and transported from the facility by manifest. Disposal of unwanted and spent chemicals through the chemical waste disposal process is a routine practice for UO_3 personnel. It is not possible for the hypothetical compounds postulated by the identification of fluoride and thallium in this stream to exist as sole active ingredients in chemical products used at the UO_3 Plant and go unnoticed by personnel. Sources for fluoride are ubiquitous. Sources for thallium are more rare. There is no connection between the hypothetical compounds postulated by the sampling data and the information available through process knowledge, other than the discovery of the 0.45 kg hydrogen fluoride (discussed in Section 5.3) which was properly manifested from the facility.

4.2 STREAM DEPOSITION RATES

Table 4-2 has been included to provide deposition rates using the mean values from Table 3-3 adjusted according to flow data from Section 2.0.

Table 4-1. Evaluation of UO_3/U Plant Wastewater.

Constituent	Result[a]	SV1[b]	SV2[c]
Barium	2.9E-02	5.0E+00 g	
Chloride	9.3E-01	2.5E+02 h	
Copper	1.9E-02	1.0E+00 h	
Fluoride	1.3E-01	2.0E+00 g	
Iron	3.1E-02	3.0E-01 h	
Nitrate	5.2E-01	4.5E+01 e	
Sulfate	1.0E+01	2.5E+02 h	
Thallium	5.5E-03	2.0E-03 e*	
Zinc	5.3E-03	5.0E+00 h	
Alpha Activity (pCi/L)[d]	1.8E+00	1.5E+01 g	3.0E+01
Beta Activity (pCi/L)	2.2E+00		1.0E+03
^{60}Co (pCi/L)	6.2E-01	2.0E+02 e	5.0E+03
$^{239/240}$Pu (pCi/L)[e]	3.6E-03	4.0E+01 e	3.0E+01
^{234}U (pCi/L)	6.5E-01		5.0E+02
^{235}U (pCi/L)	5.6E-02		6.0E+02
^{238}U (pCi/L)	5.1E-01		6.0E+02
TDS	7.0E+01	5.0E+02 h	

NOTES:

[a]Units of results are mg/L unless indicated otherwise. The results are the mean values reported in the Statistics table of Section 3.0.

[b]Screening Value 1 (SV1) lists the value first, basis second and an asterisk (*) third if the result exceeds the regulatory value. The basis is the proposed primary MCL (e), the proposed secondary MCL (f), the primary MCL (g), or the secondary MCL (h). The value is the smaller of two MCLs: the proposed primary MCL (or the primary MCL as a default) or the proposed secondary MCL (or the secondary MCL as a default). See WHC-EP-0342, "Hanford Site Stream-Specific Reports", August 1990.

[c]Screening Value 2 (SV2) lists the value first and an asterisk (*) second if the result exceeds the SV2). These values are derived concentration guides obtained from Appendix A of WHC-CM-7-5, "Environmental Compliance Manual", Revision 1, January 1990.

[d]The SV1 value for Pu-239 is used to evaluate Pu-239/Pu-240.

[e]The SV1 and SV2 values for Gross Alpha are used to evaluate Alpha Activity.

[o]The SV2 for Gross Beta is used to evaluate Beta Activity.

Table 4-2. Deposition Rate for UO_3/U Plant Wastewater.
Flow Rate: 2.24E+07 L/mo

Constituent	Kg/L*	Kg/mo*
Barium	2.92E-08	6.54E-01
Boron	1.95E-08	4.37E-01
Calcium	1.79E-05	4.01E+02
Chloride	9.30E-07	2.08E+01
Copper	1.87E-08	4.19E-01
Fluoride	1.29E-07	2.89E+00
Iron	3.12E-08	6.99E-01
Magnesium	4.31E-06	9.65E+01
Nitrate	5.24E-07	1.17E+01
Potassium	7.16E-07	1.60E+01
Silicon	2.15E-06	4.81E+01
Sodium	1.98E-06	4.43E+01
Strontium	9.42E-08	2.11E+00
Sulfate	1.00E-05	2.24E+02
Thallium	5.50E-09	1.23E-01
Uranium	1.32E-09	2.96E-02
Zinc	5.25E-09	1.18E-01
Ammonia	5.32E-08	1.19E+00
Alpha Activity *	1.82E-12	4.08E-05
Beta Activity *	2.20E-12	4.93E-05
TDS	6.95E-05	1.56E+03
TOC	1.00E-06	2.24E+01
Total Carbon	1.51E-05	3.38E+02
TOX (as Cl)	1.22E-08	2.73E-01
^{60}Co *	6.25E-13	1.40E-05
$^{239/240}Pu$ *	3.55E-15	7.95E-08
^{234}U *	6.52E-13	1.46E-05
^{235}U *	5.64E-14	1.26E-06
^{238}U *	5.08E-13	1.14E-05

NOTES:

Data collected from October 1989 through March 1990.

Flow rate is the average of rates from Section 2.3.1.

Constituent concentrations are average values from the Statistics Report in Section 3.0.

Concentration units of flagged (*) constituents are reported as curies per liter.

Deposition rate units of flagged (*) constituents are reported as curies per month.

This page intentionally left blank.

5.0 DESIGNATION

This section proposes that the UO_3/U Plant Wastewater stream not be designated as a dangerous waste. This designation uses data from both the effluent source description and sample data (Sections 2.0 through 4.0) and complies with the designation requirements of WAC 173-303-070.

The Washington State Dangerous Waste Regulations (WAC 173-303) (Ecology 1989) provide the basis for determining whether a waste is a dangerous waste. The designation strategy is illustrated in Figure 5-1 and utilizes information from the following sections of WAC 173-303:

- Dangerous Waste Lists (WAC 173-303-080)
- Dangerous Waste Criteria (WAC 173-303-100)
- Dangerous Waste Characteristics (WAC 173-303-090).

5.1 DANGEROUS WASTE LISTS

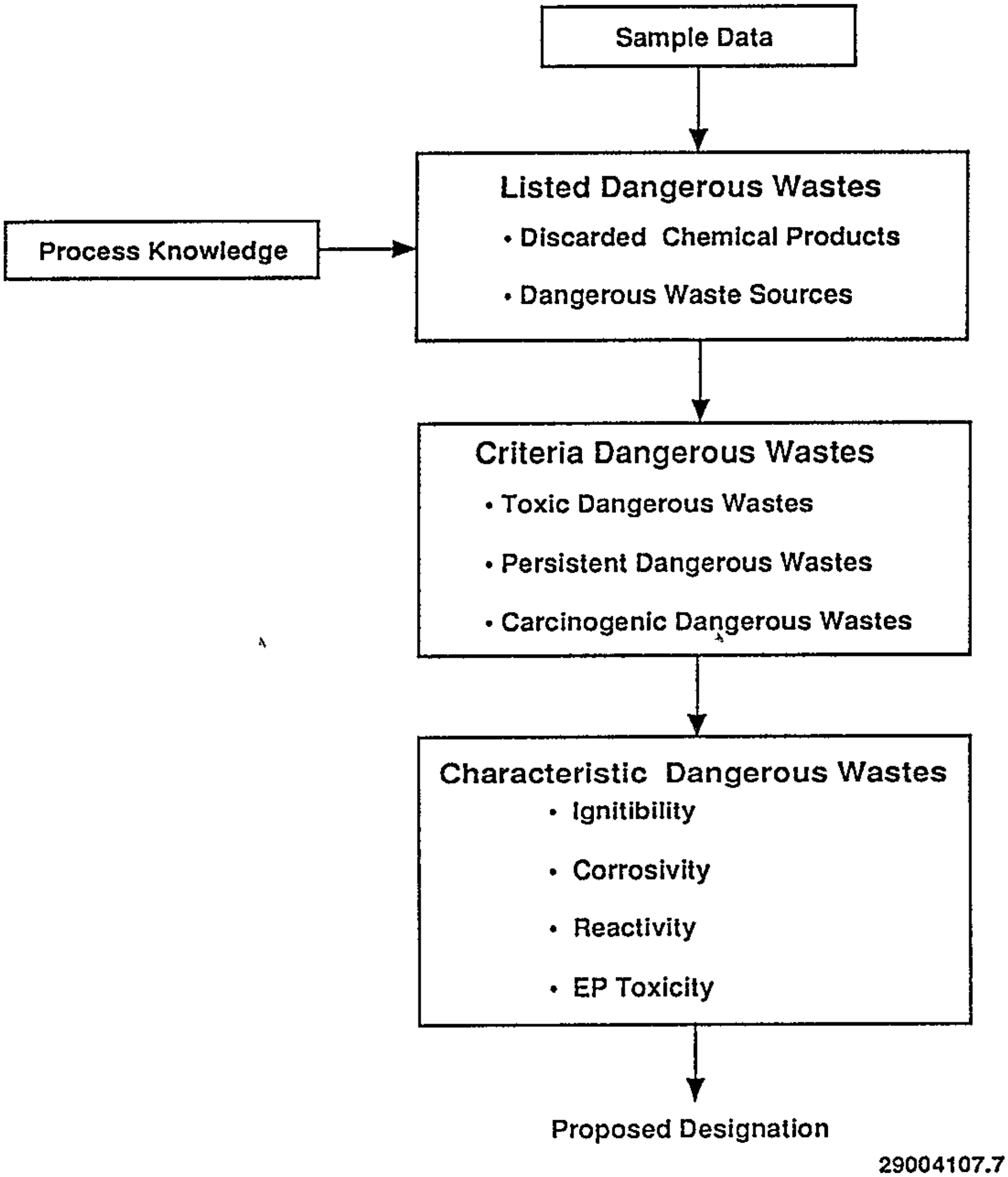
A waste is considered a dangerous waste if it either contains a discarded chemical product (WAC 173-303-081) or originates from a dangerous waste source (per WAC 173-303-082). The proposed designation was based on a combination of process knowledge and sampling data.

5.1.1 Discarded Chemical Products

A wastestream constituent is a discarded chemical product if it is listed in WAC 173-303-9903 and is characterized by one or more of the following descriptions.

- The listed constituent is the sole active ingredient in a commercial chemical product that has been discarded. (Commercial chemical products, which as purchased, contain two or more active ingredients are not designated as discarded chemical products.) Products that contain nonactive components such as water, however, are designated if the sole active ingredient in the mixture is listed in WAC 173-303-9903.
- The constituent is discarded in the form of a residue resulting from cleanup of a spill of an unused commercial chemical product on the discarded chemical products list. (A chemical product that is used in a process and then released is not a discarded chemical product. Off-specification, unused chemicals, and chemicals that have exceeded a shelf life but have not been used are considered discarded chemical products.)

Figure 5-1. Designation Strategy.



- The constituent results from a spill of unused commercial chemical products. (A spill of a discarded chemical product would cause a wastestream to be designated during the time that the discharge is occurring. The current wastestream would not be designated unless a review of past spill events indicates that the spills are predictable, systematic events that are ongoing or are reasonably anticipated to occur in the future. In this report, the evaluation of this criterion is based on a review of spill data reported in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act* [CERCLA]).

5.1.2 Dangerous Waste Sources

A list of dangerous waste sources is contained in WAC 173-303-9904, pursuant to WAC 173-303-082. There are three major categories of sources in WAC 173-303-9904. The first is nonspecific sources from routine maintenance operations occurring at many industries. The second is specific sources (e.g., wastes from ink formulation, etc.), none of which occur at the UO_3/U Plant. The third is state sources, which is limited to PCB-contaminated transformers and capacitors resulting from salvaging, rebuilding, or discarding activities.

5.2 LISTED WASTE DATA CONSIDERATIONS

The proposed designation of the wastestream described in this report is based on an evaluation of process and sampling data. The following sections describe the types of information used in this designation.

5.2.1 Process Evaluation

At the UO_3 Plant, waste disposal guidance is always available to plant personnel. An Environmental Engineer advises employees about federal, state, and company requirements with respect to the handling of dangerous wastes. Employees have been instructed to never dispose of wastes of a chemical nature without going through the chemical waste disposal process. Employees have also been alerted to the potential consequences of disregarding environmental laws. Satellite stations are available for temporary staging of dangerous wastes; briefings are periodically held to assure that the importance of environmental compliance is given high priority in daily activities. Although employees are well aware of the importance associated with proper waste dispositioning, part of the process evaluation included asking employees if they had ever disposed of or knew of anyone else disposing of chemicals to a drain or vessel.

The process evaluation began with a thorough review of the processes contributing to the wastestream. Processes were reviewed and compared with the discarded chemical products list and the dangerous waste sources list. This process evaluation was necessary because the stream could be designated as waste from a listed source if a listed waste is known to have been added at any upstream location, even if a listed constituent could not be detected at the sample point. The process evaluation included a review of the following information sources:

- Material Safety Data Sheets (MSDS)
- Superfund Amendments and Reauthorization Act (SARA) Title III Inventory reports
- Operating procedures
- Process chemical inventories
- Physical inspections, where possible.

Interviews with appropriate facility personnel were conducted to determine if any activities had taken place that may have resulted in generation of wastes from listed sources which may not have been evident during other facets of the process evaluation. These interviews, as well as a review of procedures addressing the dispositioning of chemical products that become dangerous wastes, provided no evidence that any chemical meeting the above criteria had been disposed of to this stream. If a commercial product containing a chemical addressed in the lists was identified, the specific use of the chemical was evaluated to determine if such use resulted in the generation of a waste identified in the discarded chemical product list. Furthermore, if a waste was determined to be generated, waste manifests were reviewed to ensure that proper dispositioning had occurred.

5.2.2 Sampling Data

Sampling data were used as screening tools to enhance and support the results of the process evaluation. This step consisted of comparing the results of the sampling data to the WAC 173-303-9903 and 9904 lists. If a constituent was cited on one or both of these lists, an engineering evaluation was performed to determine if the constituent had either entered the wastestream as a discarded chemical product or from a dangerous waste source.

Screening organic constituents is a relatively simple procedure because analytical data for organic constituents are reported as substances and are easily compared to the WAC 173-303-9903 and -9904 lists. It is not as simple to screen inorganic analytical data because inorganic data are reported as ions rather than as chemical substances. For example, an analysis may show that a wastestream contains the cations sodium and calcium along with the anions chloride and nitrate. The possible combinations of substances include: sodium chloride, sodium nitrate, calcium chloride, and calcium nitrate. In a situation with many cation and anions, the list of possible combinations is extensive.

A procedure was developed for Westinghouse Hanford Company for combining the inorganic constituents to produce hypothetical chemical compounds. A detailed discussion of this procedure can be found in WHC-EP-0334, *Wastestream Designation for Liquid Effluent Analytical Data* (WHC 1990b). Table 5-1 documents the ion analyte pairing which results in neutral compounds. This method is intended to be used as a tool in the evaluation of a wastestream. The identification of the inorganic substances developed by this screening procedure is not intended to be an indication that the substance was discharged to the wastestream, only that the necessary cations and anions are present and an investigation should be conducted to determine how they entered the wastestream.

5.3 PROPOSED LISTED WASTE DESIGNATIONS

A process evaluation, along with a review of sampling data, indicates that the UO_3/U Plant Wastewater has not contained waste from either the discarded chemical products list or the dangerous waste sources list. The following sections discuss the evaluation that was conducted to substantiate this conclusion.

5.3.1 Discarded Chemical Products

As discussed in Section 5.2, a process evaluation of the contributors to the UO_3/U Plant Wastewater was conducted. This evaluation included a review of MSDSs at the plant and chemical inventories compiled for compliance with the SARA Title III requirements for possible listed waste contributors.

Five potential discarded chemical products were identified from the sampling data (using the screening procedure described in Section 5.2). These compounds (hydrogen fluoride; thallium (I) chloride; thallium (I) nitrate; thallium (III) oxide; and thallium (I) sulfate) were identified as not being present in the facility during the process evaluation.

Based on the considerations and data presented in the following sections, it is concluded that the wastestream does not contain any discarded chemical products.

5.3.1.1 Hydrogen Fluoride. Hydrogen fluoride has been identified as a compound hypothetically existing in this stream by computer cation-anion match of fluoride with available hydrogen. A physical inspection of the facility was conducted to ensure proper identification of all chemicals in stock. The MSDS information was also reviewed to reinforce knowledge of chemical constituents in products. This search, along with interviews with plant personnel, indicated that there are no chemical products in current plant inventories containing this substance as an active ingredient. Review of past spill reports revealed no evidence of any past incident involving a spill of hydrogen fluoride at the facility. The only identification of hydrogen fluoride at the facility came from a review of historical manifests. A past manifest indicates that a plastic container with 0.45 kg of 48.5% hydrogen fluoride was found in a processing cell (apparently from past thorium processing activities) and transferred from the facility as dangerous waste on January 28, 1987.

Table 5-1. Inorganic Constituents from Ion Analytes. (sheet 1 of 2)

Constituent	ppb	Ion	Eq/g	Normalized
Charge Normalization:				
Barium	3.00E+01	Ba+2	4.37E-10	
Boron	2.85E+01	B407-2	1.32E-09	4.33E-09
Calcium	1.81E+04	Ca+2	9.02E-07	
Chloride	9.69E+02	Cl-1	2.73E-08	8.96E-08
Copper	2.67E+01	Cu+2	8.40E-10	
Fluoride	1.37E+02	F-1	7.20E-09	2.36E-08
Iron	3.33E+01	Fe+3	1.79E-09	
Magnesium	4.54E+03	Mg+2	3.74E-07	
Nitrate	5.64E+02	NO3-1	9.10E-09	2.98E-08
Potassium	7.45E+02	K+1	1.90E-08	
Silicon	2.22E+03	SiO3-2	1.58E-07	5.19E-07
Sodium	2.07E+03	Na+1	9.00E-08	
Strontium	9.78E+01	Sr+2	2.23E-09	
Sulfate	1.06E+04	SO4-2	2.21E-07	7.25E-07
Thallium	6.32E+00	Tl+1	3.09E-11	
Uranium	2.38E+00	UO2+2	2.00E-11	
Zinc	5.66E+00	Zn+2	1.73E-10	
Hydrogen Ion (from pH 6.6)		H+	(2.53E-10)	
Hydroxide Ion (from pH)		OH-	(3.95E-11)	
Cation total			1.39E-06	
Anion total			4.24E-07	
Anion normalization factor:	3.278			

Substance Formation:

Substance	%	Cation Out	Anion Out
Copper(II) chloride	5.65E-06	0.00E+00	8.88E-08
Thallium(I) chloride	7.41E-07	0.00E+00	8.87E-08
Uranyl nitrate	3.95E-07	0.00E+00	2.98E-08
Iron(III) fluoride	6.73E-06	0.00E+00	2.18E-08
Potassium fluoride	1.11E-04	0.00E+00	2.75E-09
Barium chloride	4.55E-06	0.00E+00	8.83E-08
Sodium fluoride	1.16E-05	8.72E-08	0.00E+00
Zinc nitrate	1.64E-06	0.00E+00	2.96E-08
Magnesium chloride	4.20E-04	2.85E-07	0.00E+00
Magnesium nitrate	2.33E-04	2.56E-07	0.00E+00
Calcium tetraborate	4.22E-05	8.98E-07	0.00E+00
Magnesium sulfate	1.54E-03	0.00E+00	4.69E-07
Sodium metasilicate	5.33E-04	0.00E+00	4.31E-07
Strontium sulfate	2.05E-05	0.00E+00	4.66E-07
Calcium sulfate	3.18E-03	4.31E-07	0.00E+00

Table 5-1. Inorganic Constituents from Ion Analytes. (sheet 2 of 2)

NOTES:

Statistics based on a single datum are noted by an asterisk (*). With the exception of hydrogen ion and hydroxide, others report the upper limit of the one-tailed 90% confidence interval. Hydrogen ion is based on the lower limit of the one-tailed 90% confidence interval for pH sets with mean values below 7.25 and on the upper limit of the one-tailed 90% confidence interval for pH data sets with mean values of 7.25 or higher. The hydroxide magnitude is equal to 1.00E-20 equivalents per gram (Eq/g)**2 divided by the hydrogen ion value (in Eq/g).

Ion concentrations in Eq/g are based on the statistic. Conversions include scale (ppb to g/g), molecular weight (constituent form to ionic form), and equivalents (charges per ion). The column headed "Normalized" shows normalized concentrations (also in Eq/g) calculated by increasing concentrations of cations, excluding Hydrogen ion, or anions, excluding hydroxide, by the normalization factor. The normalization factor is the larger of the cation total, including Hydrogen ion, or anion total, including hydroxide, divided by the smaller total.

Substance names may include MB (monobasic), DB (dibasic), TB (tribasic) to identify the equivalents of hydrogen ion that have been neutralized from polycrotic weak acids to form their conjugate bases.

Substances are formulated in the order listed. The column headed "%" is the percent of the substance in the waste (gms/100 gms). Substances formulated with oxygen are based on the residual concentration of the counterion. Other substance concentrations are based on the limiting residual concentration of the cation or anion. The columns headed "Cation Out" and "Anion Out" indicate the residual concentrations (in Eq/g) of each ion after a substance concentration has been calculated.

Fluoride was detected in four of four samples taken of the UO_3 Plant Wastewater stream. The concentration of fluoride in these samples ranged from 116 to 138 pbb. The rejection criterion for fluoride based on sanitary water supplied to the UO_3 Plant is <143 ppb as presented in Section 5.2 of the "parent" document of WHC-EP-0342. Since the concentration of fluoride detected in all samples of this wastewater stream is less than the rejection criterion, these data will not be considered in the designation of the wastestream, as it is likely that fluoride is present in these wastestream samples due to its presence in the facility water supply.

Based on the lack of potential application at the facility for hydrogen fluoride and the criterion for data rejection, it is concluded that the existence of fluoride in the UO_3 Plant Wastewater is not the result of discarded chemical products.

5.3.1.2 Thallium compounds. A physical inspection of the facility was conducted to ensure proper identification of all chemicals in stock. The MSDS information was also reviewed to reinforce knowledge of chemical constituents in products. This search, along with interviews with plant personnel, indicated that there are no chemical products in current plant inventories containing thallium or any thallium compound as an active ingredient. Review of past spill reports revealed no evidence of any past incident involving a spill of any thallium-containing substances at the facility.

Thallium has been identified in this stream above the detection limit of 5 ppb in one of four samples taken. The concentration of this sample was 7 pbb. This sample result is just above the detection limit and constitutes the only detection of thallium in all samples taken (old and new data) on the 33 streams; additionally, discussions with personnel at other plants revealed no known uses of thallium-containing compounds in facilities at the Hanford Site.

Thallium may be present as an impurity in the potassium nitrate desiccant used at the facility. *The Encyclopedia of Chemistry* (Hampel and Hawley 1973) identifies thallium as one of the lesser known metals because of limited applications, but that its abundance in the earth's crust is on the same order of magnitude as mercury. Thallium is present in greater amounts in pot ash (salts of potassium) minerals. Analysis information received from the manufacturer revealed no evidence that thallium is analyzed for in assay tests.

The detection of thallium may either represent an anomaly of the data or may possibly result from an elevated impurity level in potassium carbonate. Process knowledge, coupled with an extensive search at the facility for chemicals that are identified as containing thallium, indicates that this element has not found its way to the stream as the result of chemical product disposal.

5.3.2 Dangerous Waste Sources

The process evaluation (see Section 5.2) was also used to determine if the wastestream included any specific waste sources (K and W wastes) or any nonspecific waste sources (F wastes) in the Dangerous Waste Source List WAC 173-303-9904.

Sampling data were utilized to enhance the process evaluation. No potential listed solvents were identified by the sampling data; however, one potential listed solvent was identified as being used in the facility. Acetone is used by instrument technicians to clean dirty manometer lines. Discussion with a senior instrument technician who has been at the facility since the inception of the current processing configuration (1984) indicates that waste generated from the use of acetone has always been containerized and disposed of as dangerous waste. Additional conversations with other plant personnel provided no evidence of spent solvent disposal to the wastestream. Therefore, it is concluded that the wastestream does not have a dangerous waste source.

5.4 DANGEROUS WASTE CRITERIA

A waste is considered a dangerous waste if it meets any of the following criteria categories (WAC 173-303-100): toxic dangerous waste, persistent dangerous waste, or carcinogenic dangerous waste. A description of the methods used to test the sampling data against the criteria is contained in WHC (1990b). Summaries of the methods, along with the results, are contained in the following sections.

5.4.1 Toxic Dangerous Wastes

The procedure for determining if a wastestream is a toxic dangerous waste (WAC 173-303-101) is as follows:

- Collect and analyze multiple samples from the wastestream.
- Calculate the upper limit of the one-sided 90% confidence interval (CI) for each analyte in the wastestream.
- Formulate substances from the analytical data. NOTE: This step is required only for inorganic analytes, since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology is described in WHC (1990b) and is based on a evaluation of the most toxic substances that can exist in an aqueous environment under normal temperatures and pressures.

- Assign toxic categories to the substances detected in, or for the case of inorganic analyte pairings, postulated to be in the wastestream.

- Calculate the contribution of each substance to the percent equivalent concentration (EC%).

- Calculate the EC% by summing the contributions of each substance.

- Designate the wastestream as a toxic dangerous waste if the EC% is greater than 0.001, per WAC 173-303-9906.

Fourteen substances potentially present in the UO_3/U Plant Wastewater were determined to have toxic categories associated with them. These substances are listed in Table 5-2. The three highest contributors to the toxic EC% are potassium fluoride, copper (II) chloride, and magnesium sulfate. Since the EC% sum is 1.11 E-06, which is less than the cutoff of 1.0 E-03 (i.e., 0.001%), the wastestream is not a toxic dangerous waste.

5.4.2 Persistent Dangerous Wastes

The procedure for determining if a wastestream is a persistent dangerous waste (WAC 173-303-102)is as follows:

- Collect multiple grab samples of the wastestream.

- Determine which substances in the wastestream are halogenated hydrocarbons (HH) and which are polycyclic aromatic hydrocarbons (PAH).

- Determine the upper limit of the one-sided 90%CI for the substances of interest.

- Calculate the weight percent contribution of each HH and PAH.

- Sum the weight percent of the contributors, separately.

- Designate the wastestream as persistent if the weight percent contribution of the HH is >0.01% or if the weight percent contribution of the PAH is >1.0%, per WAC 173-303-9907.

No substances potentially present in the UO_3/U Plant Wastewater were determined to be HH and no substances were determined to be PAH. Therefore, the UO_3/U Plant Wastewater wastestream is not a persistent dangerous waste.

Table 5-2. Dangerous Waste Data Designation Report for UO_3/U Plants Wastewater. (sheet 1 of 2)

Dangerous Waste Data Designation Report for U03/U Plants Wastewater

Finding: Undesignated

Discarded Chemical Products - WAC 173-303-081

Substance	Review Number	Status	DW Number
Hydrogen fluoride	U134(DW)	Not Discarded	Undesignated
Thallium(I) chloride	U216(DW)	Not Discarded	Undesignated
Thallium(I) nitrate	U217(DW)	Not Discarded	Undesignated
Thallium(III) oxide	P113(EHW)	Not Discarded	Undesignated
Thallium(I) sulfate	P115(EHW)	Not Discarded	Undesignated

Dangerous Waste Sources - WAC 173-303-082

Substance	Review Number	Status	DW Number
None	None	Not applicable	None

Infectous Dangerous Waste - WAC 173-303-083

No regulatory guidance

Dangerous Waste Mixtures - WAC 173-303-084

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%
Barium chloride	4.55E-09	0.00E+00	0.00E+00	0.00E+00
Calcium tetraborate	4.22E-09	0.00E+00	0.00E+00	0.00E+00
Copper(II) chloride	5.65E-07	0.00E+00	0.00E+00	0.00E+00
Iron(III) fluoride	6.73E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium chloride	4.20E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium nitrate	2.33E-08	0.00E+00	0.00E+00	0.00E+00
Magnesium sulfate	1.54E-07	0.00E+00	0.00E+00	0.00E+00
Potassium fluoride	1.11E-07	0.00E+00	0.00E+00	0.00E+00
Sodium fluoride	1.16E-08	0.00E+00	0.00E+00	0.00E+00
Sodium metasilicate	5.33E-08	0.00E+00	0.00E+00	0.00E+00
Thallium(I) chloride	7.41E-09	0.00E+00	0.00E+00	0.00E+00
Uranyl nitrate	3.95E-09	0.00E+00	0.00E+00	0.00E+00
Zinc nitrate	1.64E-09	0.00E+00	0.00E+00	0.00E+00
Ammonia	5.86E-08	0.00E+00	0.00E+00	0.00E+00
Total	1.11E-06	0.00E+00	0.00E+00	0.00E+00
DW Number	Undesignated	Undesignated	Undesignated	Undesignated

Dangerous Waste Characteristics - WAC 173-303-090

Characteristic	Value	DW Number
Ignitability (Degrees F)	>198	Undesignated
Corrosivity-pH	6.60	Undesignated
Reactivity Cyanide (mg/kg)	<1.00E+02	Undesignated
Reactivity Sulfide (mg/kg)	<1.00E+02	Undesignated
EP Toxic Arsenic (mg/L)	<5.00E-01	Undesignated
EP Toxic Barium (mg/L)	<1.00E+00	Undesignated
EP Toxic Cadmium (mg/L)	<1.00E-01	Undesignated
EP Toxic Chromium (mg/L)	<5.00E-01	Undesignated
EP Toxic Lead (mg/L)	<5.00E-01	Undesignated
EP Toxic Mercury (mg/L)	<2.00E-02	Undesignated
EP Toxic Selenium (mg/L)	<5.00E-01	Undesignated
EP Toxic Silver (mg/L)	<5.00E-01	Undesignated

Table 5-2. Dangerous Waste Data Designation Report for UO_3/U Plants Wastewater. (sheet 2 of 2)

Dangerous Waste Data Designation Report for U03/U Plants Wastewater

Dangerous Waste Criteria - WAC 173-303-100

Substance	Toxic EC%	Persistant HH%	Persistant PAH%	Carcinogenic Total%	DW Number-Positive
Barium chloride	4.55E-09	0.00E+00	0.00E+00	0.00E+00	
Calcium tetraborate	4.22E-09	0.00E+00	0.00E+00	0.00E+00	
Copper(II) chloride	5.65E-07	0.00E+00	0.00E+00	0.00E+00	
Iron(III) fluoride	6.73E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium chloride	4.20E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium nitrate	2.33E-08	0.00E+00	0.00E+00	0.00E+00	
Magnesium sulfate	1.54E-07	0.00E+00	0.00E+00	0.00E+00	
Potassium fluoride	1.11E-07	0.00E+00	0.00E+00	0.00E+00	
Sodium fluoride	1.16E-08	0.00E+00	0.00E+00	0.00E+00	
Sodium metasilicate	5.33E-08	0.00E+00	0.00E+00	0.00E+00	
Thallium(I) chloride	7.41E-09	0.00E+00	0.00E+00	0.00E+00	
Uranyl nitrate	3.95E-09	0.00E+00	0.00E+00	0.00E+00	
Zinc nitrate	1.64E-09	0.00E+00	0.00E+00	0.00E+00	
Ammonia	5.86E-08	0.00E+00	0.00E+00	0.00E+00	
Total	1.11E-06	0.00E+00	0.00E+00	0.00E+00	
DW Number	Undesignated	Undesignated	Undesignated	Undesignated	

Dangerous Waste Constituents - WAC 173-303-9905

Substance
Hydrogen fluoride
Thallium(I) chloride
Thallium(I) nitrate
Thallium(III) oxide
Thallium(I) sulfate
Barium and compounds,NOS
Thallium and compounds,NOS

Substance names may include MB (monobasic), DB (dibasic), or TB (tribasic) to identify the equivalence of hydrogen ion that have been nutralized from polyprotic weak acids to form their conjugate bases.

Results based on a single datum are noted by an asterisk (*). Others are based on the lower limit of the one-tailed 90% confidence interval for pH data sets with mean values below 7.25 or by the upper limit of the one-tailed 90% confidence interval for all other data sets.

EP Toxic contaminants, ignitability, and reactivity are reported by standard methods when available. In the absence of EP Toxicity data, total contaminant concentrations are evaluated. In lieu of closed cup ignition results, ignitability is estimated from the sum of the contributions of all substances that are ignitable when pure. A waste is flagged as dangerous if sum of the ignitable substances exceeds one percent. Reactivity is by SW-846: 250 mg of cyanide as hydrogen cyanide per kg of waste or 500 mg of sulfide as hydrogen sulfide per kg of waste. Total cyanide and total sulfide are used in lieu of amenable cyanide and amenable sulfide.

Inorganic substances are fomulated and their possible concentrations calculated for designation purposes only. The actual existance in the waste of these substances is not implied and should not be infered.

5.4.3 Carcinogenic Dangerous Wastes

The procedure for determining if a wastestream is a carcinogenic dangerous waste is as follows (WAC 173-303-103).

- Collect multiple grab samples of the wastestream.
- Determine the upper limit of the one-sided 90%CI for the substances of interest.
- Formulate substances from the analytical data. NOTE: This step is only required for inorganic analytes since it is not possible to complete the evaluation based on the concentration of cations and anions. This methodology (WHC 1990b) is based on an evaluation of the carcinogenic substances that exist in an aqueous environment under normal temperatures and pressures.
- Determine which substances in the wastestream are carcinogenic according to the International Agency for Research on Cancer (IARC).
- Calculate the weight percent concentration for each carcinogen.
- Sum the resulting weight percent.
- Designate the wastestream as carcinogenic if any of the positive (human or animal) carcinogens are above 0.01% or if the total concentration for positive and suspected (human or animal) carcinogens is above 1.0%.

No substances potentially present in the UO_3/U Plant Wastewater were determined to be carcinogenic. Therefore, the UO_3/U Plant Wastewater is not a carcinogenic dangerous waste.

5.5 DANGEROUS WASTE CHARACTERISTICS

A waste is considered a dangerous waste if it is ignitable, corrosive, reactive, or extraction procedure (EP) toxic (WAC 173-303-090). A description of the methods used to evaluate the data in terms of these characteristics is contained in WHC (1990b). Summaries of the methods, along with the results, are contained in the following sections.

5.5.1 Ignitability

Because of the dilute aqueous nature of these wastes, flashpoint testing was not performed on initial samples collected from the wastestream; instead, the ignitability index was calculated for the samples and was based on the sum of the concentrations of all ignitable contributors in the waste. Pure substances with a flashpoint <140 °F were considered ignitable. Using best professional judgment, samples that exhibited an ignitability index below 1% were not considered ignitable.

Since July 1989, flashpoint testing has been performed on many of the liquid effluent samples. All samples reached the boiling temperature of water without igniting.

The value of the ignitability index calculated for UO_3/U Plant Wastewater is zero. Based on this index, the UO_3/U Plant Wastewater is not an ignitable waste.

5.5.2 Corrosivity

A waste is a corrosive dangerous waste if it has a pH of ≤ 2.0 or ≥ 12.5. The comparison to this characteristic was based on the lower limit of the 90%CI for a stream with a mean value of pH ≤ 7.25 and the upper limit of the 90%CI for a stream with a mean value of pH ≥ 7.25. Because the pH values observed during sampling were between 6.25 and 7.40, the UO_3/U Plant Wastewater is not a corrosive dangerous waste (WAC 173-303-090[6]).

5.5.3 Reactivity

An aqueous waste is reactive if the waste contains an amount of cyanide or sulfide under conditions near corrosivity sufficient to threaten human health or the environment (WAC 173-303-090[7]). A recent revision to the *Test Methods for Evaluating Solid Waste* (EPA 1986) provides more quantitative indicator levels for cyanide and sulfide. It states that levels of (equivalent) HCN below 250 ppm or of (equivalent) H_2S below 500 ppm would not be considered reactive. If the upper 90%CI for the compounds in the effluent streams was below these levels, the streams were considered not regulated based on reactivity.

For samples collected before July 1989, total cyanide and total sulfide were used to evaluate reactivity. The revised SW-846 (EPA 1986) procedure was used for samples collected since July 1989.

The concentrations of total cyanide and total sulfide were both below the detection limits of 100 ppm. Therefore, this wastestream is not a reactive dangerous waste.

5.5.4 Extraction Procedure Toxicity

A waste is an EP toxic dangerous waste if individual chemical analytes exceed limits of WAC 173-303-090(8)(c). Eight analytes with concentrations above detection limits that are on the EP toxic list were found in the UO_3 Plant Wastewater. The concentrations of these analytes are listed in Table 5-2. Because their concentrations are all below their respective limits, the UO_3 Plant Wastewater is not an EP toxic dangerous waste.

5.6 PROPOSED DESIGNATIONS

Based upon the analysis of samples taken from October 1989 to March 1990 and an evaluation of the process, it is believed that the UO_3 Plant Wastewater does not contain any dangerous waste as defined in WAC 173-303. It is proposed that the wastestream not be designated a dangerous waste.

This page intentionally left blank.

6.0 ACTION PLAN

This chapter addresses recommendations for future waste characterization tasks for the liquid effluents that are within the scope of the *Liquid Effluent Study Project Plan* (WHC 1990a). The final extent of and schedule for any recommended tasks are subject to negotiation between Ecology, the EPA, and DOE. An implementation schedule for the completion of these tasks will be given consideration in addition to other compliance actions already under way as part of the Tri-Party Agreement (Ecology et al. 1989), contingent upon the availability of funding. All effluent monitoring and sampling will be conducted according to DOE Order 5400.1 (DOE 1988).

6.1 FUTURE SAMPLING

The random sampling conducted during the October 1989 to March 1990 period covered the plant during the standby mode only. Since the plant has not operated since May 1989, random sampling during calcination mode was not performed during the above time period. Even though operation of the plant essentially results merely in an increased volume of cooling water and steam used, it is recommended that additional samples of the wastestream be taken during the next calcination period.

Although it was determined that listed sources for thallium were not available at the facility, it is recommended that plausible product sources (e.g., potassium carbonate and potassium hydroxide) be assayed to conclude the diligent search with respect to the origin of thallium in the wastestream.

6.2 TECHNICAL ISSUES

As described in Section 2.0, the effluent was sampled upstream of 207-U. This sample point was chosen because it is a common, accessible location downstream of all the contributing wastestreams. The samples collected at this point are considered to be representative of the types of constituents present in the contributing wastestreams. As a result, the characterization data presented in this report is considered to be representative of the effluent stream.

This page intentionally left blank.

7.0 REFERENCES

APHA, 1985, *Standard Methods for the Examination of Water and Wastewater*, Sixteenth Edition, American Public Health Association, American Water Works Association and Water Pollution Control Federal, Washington, D.C.

ASTM, 1986, *1986 Book of ASTM Standards*, American Society of Testing and Materials, Philadelphia, Pennsylvania.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, Public Law 96-510, 94 Stat. 2767, 42 USC 9601 et seq.

DOE, 1988, *General Environmental Protection Program*, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C.

Ecology, 1989, *Dangerous Waste Regulations*, Washington Administrative Code 173-303, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Wastes*, SW-846, Third Edition, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988, *Land Disposal Restrictions*, Title 40, Code of Federal Regulations, Part 268, U.S. Environmental Protection Agency, Washington, D.C.

Hampel, C. A. and G. G. Hawley, 1973, *The Encyclopedia of Chemistry*, Third Edition, Van Nostrand Reinhold, New York, New York.

Lawrence, M. J., 1989, "Liquid Effluent Study," (External Letter 8902106 to C. Gregoire, Washington State Department of Ecology; and R. Russell, U.S. Environmental Protection Agency, May 13, 1989), U.S. Department of Energy-Richland Operations Office, Richland, Washington

Somers, S., 1986, *Hanford Sanitary Water Quality Surveillance, CY 1985*, HEHF-55, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1987, *Hanford Sanitary Water Quality Surveillance, CY 1986*, HEHF-59, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1988, *Hanford Sanitary Water Quality Surveillance, CY 1987*, HEHF-71, Hanford Environmental Health Foundation, Richland, Washington.

Somers, S., 1989, *Hanford Sanitary Water Quality Surveillance, CY 1988*, HEHF-74, Hanford Environmental Health Foundation, Richland, Washington.

Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499, 100 Stat. 1613, USC 1001.

Thurman, P. A., 1990, *Hanford Sanitary Water Quality Surveillance, CY 1989*, HEHF-76, Hanford Environmental Health Foundation, Richland, Washington.

Windholz, M. (ed.), 1989, *The Merck Index*, 11th Ed., Merck & Co., Inc., Rahway, New Jersey.

WHC, 1988, *Preliminary Evaluation of Hanford Liquid Discharges to Ground*, WHC-EP-0052, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Waste Stream Characterization Report*, WHC-EP-0287, Volumes 1-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990a, *Liquid Effluent Study Project Plan*, WHC-EP-0275, Rev 2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990b, *Wastestream Designation of Liquid Effluent Analytical Data*, WHC-EP-0334, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

DATA SUMMARY--DATA FROM 1989 TO 1990

This page intentionally left blank.

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 1 of 6)

Constituent	Sample #	Date	Method	Result
Arsenic (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Arsenic (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Barium	50822	12/01/89	ICP	3.00E+01
Barium	51000	3/02/90	ICP	2.80E+01
Barium	51048	3/14/90	ICP	3.00E+01
Barium	51083	3/22/90	ICP	2.90E+01
Barium (EP Toxic)	50822E	12/01/89	ICP	<1.00E+03
Barium (EP Toxic)	51000E	3/02/90	ICP	<1.00E+03
Barium (EP Toxic)	51048E	3/14/90	ICP	<1.00E+03
Barium (EP Toxic)	51083E	3/22/90	ICP	<1.00E+03
Boron	50822	12/01/89	ICP	1.10E+01
Boron	51000	3/02/90	ICP	3.30E+01
Boron	51048	3/14/90	ICP	2.40E+01
Boron	51083	3/22/90	ICP	1.00E+01
Cadmium (EP Toxic)	50822E	12/01/89	ICP	<1.00E+02
Cadmium (EP Toxic)	51000E	3/02/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51048E	3/14/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51083E	3/22/90	ICP	<1.00E+02
Calcium	50822	12/01/89	ICP	1.77E+04
Calcium	51000	3/02/90	ICP	1.78E+04
Calcium	51048	3/14/90	ICP	1.82E+04
Calcium	51083	3/22/90	ICP	1.79E+04
Chloride	50822	12/01/89	IC	9.00E+02
Chloride	51000	3/02/90	IC	9.20E+02
Chloride	51048	3/14/90	IC	1.00E+03
Chloride	51083	3/22/90	IC	9.00E+02
Chromium (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Chromium (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Chromium (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Chromium (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Copper	50822	12/01/89	ICP	3.10E+01
Copper	51000	3/02/90	ICP	2.20E+01
Copper	51048	3/14/90	ICP	<1.00E+01
Copper	51083	3/22/90	ICP	1.20E+01
Fluoride	50822	12/01/89	IC	<5.00E+02
Fluoride	50822	12/01/89	ISE	1.33E+02
Fluoride	51000	3/02/90	IC	<5.00E+02
Fluoride	51000	3/02/90	ISE	1.29E+02
Fluoride	51048	3/14/90	IC	<5.00E+02
Fluoride	51048	3/14/90	ISE	1.16E+02
Fluoride	51083	3/22/90	IC	<5.00E+02
Fluoride	51083	3/22/90	ISE	1.38E+02
Iron	50822	12/01/89	ICP	<3.00E+01
Iron	51000	3/02/90	ICP	3.50E+01
Iron	51048	3/14/90	ICP	<3.00E+01
Iron	51083	3/22/90	ICP	<3.00E+01
Lead (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 2 of 6)

Constituent	Sample #	Date	Method	Result
Lead (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Lead (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Lead (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Magnesium	50822	12/01/89	ICP	3.98E+03
Magnesium	51000	3/02/90	ICP	4.17E+03
Magnesium	51048	3/14/90	ICP	4.54E+03
Magnesium	51083	3/22/90	ICP	4.55E+03
Mercury (EP Toxic)	50822E	12/01/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51000E	3/02/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51048E	3/14/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51083E	3/22/90	CVAA/M	<2.00E+01
Nitrate	50822	12/01/89	IC	5.00E+02
Nitrate	51000	3/02/90	IC	5.97E+02
Nitrate	51048	3/14/90	IC	<5.00E+02
Nitrate	51083	3/22/90	IC	<5.00E+02
Potassium	50822	12/01/89	ICP	6.86E+02
Potassium	51000	3/02/90	ICP	6.85E+02
Potassium	51048	3/14/90	ICP	7.52E+02
Potassium	51083	3/22/90	ICP	7.40E+02
Selenium (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Selenium (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Selenium (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Selenium (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Silicon	50822	12/01/89	ICP	2.22E+03
Silicon	51000	3/02/90	ICP	2.17E+03
Silicon	51048	3/14/90	ICP	2.19E+03
Silicon	51083	3/22/90	ICP	2.03E+03
Silver (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Silver (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Silver (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Silver (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Sodium	50822	12/01/89	ICP	1.89E+03
Sodium	51000	3/02/90	ICP	1.88E+03
Sodium	51048	3/14/90	ICP	2.11E+03
Sodium	51083	3/22/90	ICP	2.03E+03
Strontium	50822	12/01/89	ICP	8.80E+01
Strontium	51000	3/02/90	ICP	9.50E+01
Strontium	51048	3/14/90	ICP	9.80E+01
Strontium	51083	3/22/90	ICP	9.60E+01
Sulfate	50822	12/01/89	IC	8.90E+03
Sulfate	51000	3/02/90	IC	1.03E+04
Sulfate	51048	3/14/90	IC	1.06E+04
Sulfate	51083	3/22/90	IC	1.02E+04
Thallium	50822	12/01/89	GFAA	7.00E+00
Thallium	51000	3/02/90	GFAA	<5.00E+00
Thallium	51048	3/14/90	GFAA	<5.00E+00
Thallium	51083	3/22/90	GFAA	<5.00E+00
Uranium	50822	12/01/89	FLUOR	3.27E+00
Uranium	51000	3/02/90	FLUOR	5.75E-01

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 3 of 6)

Constituent	Sample #	Date	Method	Result
Uranium	51048	3/14/90	FLUOR	7.36E-01
Uranium	51083	3/22/90	FLUOR	6.88E-01
Zinc	50822	12/01/89	ICP	<5.00E+00
Zinc	51000	3/02/90	ICP	6.00E+00
Zinc	51048	3/14/90	ICP	5.00E+00
Zinc	51083	3/22/90	ICP	<5.00E+00
Ammonia	50822	12/01/89	ISE	6.30E+01
Ammonia	51000	3/02/90	ISE	<5.00E+01
Ammonia	51048	3/14/90	ISE	<5.00E+01
Ammonia	51083	3/22/90	ISE	<5.00E+01
1-Butanol	50822	12/01/89	DIGC	<1.00E+04
1-Butanol	51000	3/02/90	DIGC	<1.00E+04
1-Butanol	51000B	3/02/90	VOA	4.00E+01
1-Butanol	51000T	3/02/90	VOA	3.90E+01
1-Butanol	51048	3/14/90	DIGC	<1.00E+04
1-Butanol	51083	3/22/90	DIGC	<1.00E+04
Dichloromethane	50822	12/01/89	VOA	<5.00E+00
Dichloromethane	50822B	12/01/89	VOA	1.55E+03
Dichloromethane	50822T	12/01/89	VOA	1.70E+03
Dichloromethane	51000	3/02/90	VOA	<5.00E+00
Dichloromethane	51000B	3/02/90	VOA	<5.00E+00
Dichloromethane	51000T	3/02/90	VOA	<5.00E+00
Dichloromethane	51048	3/14/90	VOA	<5.00E+00
Dichloromethane	51048B	3/14/90	VOA	<3.00E+00
Dichloromethane	51048T	3/14/90	VOA	<5.00E+00
Dichloromethane	51083	3/22/90	VOA	<5.00E+00
Dichloromethane	51083B	3/22/90	VOA	<5.00E+00
Dichloromethane	51083T	3/22/90	VOA	<5.00E+00
Alkalinity (Method B)	50822	12/01/89	TITRA	5.40E+04
Alkalinity (Method B)	51000	3/02/90	TITRA	5.80E+04
Alkalinity (Method B)	51048	3/14/90	TITRA	5.90E+04
Alkalinity (Method B)	51083	3/22/90	TITRA	5.80E+04
Alpha Activity (pCi/L)	50822	12/01/89	Alpha	5.09E+00
Alpha Activity (pCi/L)	51000	3/02/90	Alpha	9.48E-01
Alpha Activity (pCi/L)	51048	3/14/90	Alpha	<8.65E-01
Alpha Activity (pCi/L)	51083	3/22/90	Alpha	<3.76E-01
Beta Activity (pCi/L)	50822	12/01/89	Beta	2.37E+00
Beta Activity (pCi/L)	51048	3/14/90	Beta	2.31E+00
Beta Activity (pCi/L)	51083	3/22/90	Beta	<1.92E+00
Conductivity (μS)	50822	12/01/89	COND-Fld	1.38E+02
Conductivity (μS)	51000	3/02/90	COND-Fld	1.23E+02
Conductivity (μS)	51048	3/14/90	COND-Fld	1.35E+02
Conductivity (μS)	51083	3/22/90	COND-Fld	1.27E+02
Ignitability (°F)	50822E	12/01/89	IGNIT	2.10E+02
Ignitability (°F)	51000E	3/02/90	IGNIT	2.10E+02
Ignitability (°F)	51048E	3/14/90	IGNIT	2.02E+02
Ignitability (°F)	51083E	3/22/90	IGNIT	1.96E+02
pH (dimensionless)	50822	12/01/89	PH-Fld	6.25E+00
pH (dimensionless)	51000	3/02/90	PH-Fld	7.40E+00

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 4 of 6)

Constituent	Sample #	Date	Method	Result
pH (dimensionless)	51048	3/14/90	PH-Fld	7.22E+00
pH (dimensionless)	51083	3/22/90	PH-Fld	7.23E+00
Reactivity Cyanide (mg/kg)	50822E	12/01/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51000E	3/02/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51048E	3/14/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51083E	3/22/90	DSPEC	<1.00E+02
Reactivity Sulfide (mg/kg)	50822E	12/01/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51000E	3/02/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51048E	3/14/90	DTITRA	<1.00E+02
TDS	50822	12/01/89	TDS	6.60E+04
TDS	51000	3/02/90	TDS	6.40E+04
TDS	51048	3/14/90	TDS	6.90E+04
TDS	51083	3/22/90	TDS	7.90E+04
Temperature (°C)	50822	12/01/89	TEMP-Fld	1.61E+01
Temperature (°C)	51000	3/02/90	TEMP-Fld	9.70E+00
Temperature (°C)	51048	3/14/90	TEMP-Fld	1.02E+01
Temperature (°C)	51083	3/22/90	TEMP-Fld	1.27E+01
TOC	50822	12/01/89	TOC	<1.20E+03
TOC	51000	3/02/90	TOC	<9.00E+02
TOC	51048	3/14/90	TOC	1.10E+03
TOC	51083	3/22/90	TOC	1.00E+03
Total Carbon	50822	12/01/89	TC	1.45E+04
Total Carbon	51000	3/02/90	TC	1.51E+04
Total Carbon	51048	3/14/90	TC	1.55E+04
Total Carbon	51083	3/22/90	TC	1.55E+04
TOX (as Cl)	50822	12/01/89	LTOX	1.10E+01
TOX (as Cl)	51000	3/02/90	LTOX	1.20E+01
TOX (as Cl)	51048	3/14/90	LTOX	1.10E+01
TOX (as Cl)	51083	3/22/90	LTOX	1.50E+01
^{60}Co (pCi/L)	50822	12/01/89	GEA	<1.18E-01
^{60}Co (pCi/L)	51000	3/02/90	GEA	<5.33E-02
^{60}Co (pCi/L)	51048	3/14/90	GEA	1.23E+00
^{60}Co (pCi/L)	51083	3/22/90	GEA	1.10E+00
$^{239/240}$Pu (pCi/L)	51000	3/02/90	AEA	<1.75E-03
$^{239/240}$Pu (pCi/L)	51048	3/14/90	AEA	<2.65E-03
$^{239/240}$Pu (pCi/L)	51083	3/22/90	AEA	6.24E-03
^{234}U (pCi/L)	50822	12/01/89	AEA	1.59E+00
^{234}U (pCi/L)	51000	3/02/90	AEA	3.43E-01
^{234}U (pCi/L)	51048	3/14/90	AEA	3.41E-01
^{234}U (pCi/L)	51083	3/22/90	AEA	3.36E-01
^{235}U (pCi/L)	50822	12/01/89	AEA	1.90E-01
^{234}U (pCi/L)	51000	3/02/90	AEA	2.41E-02
^{235}U (pCi/L)	51048	3/14/90	AEA	<5.56E-03
^{235}U (pCi/L)	51083	3/22/90	AEA	<5.75E-03
^{238}U (pCi/L)	50822	12/01/89	AEA	1.17E+00
^{238}U (pCi/L)	51000	3/02/90	AEA	3.16E-01
^{238}U (pCi/L)	51048	3/14/90	AEA	2.82E-01
^{238}U (pCi/L)	51083	3/22/90	AEA	2.66E-01

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 5 of 6)

NOTES:
Sample # is the number of the sample. See Section 3.0 for corresponding chain-of-custody number.
Date is the sampling date.
Results are in ppb (parts per billion) unless otherwise indicated.

The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Americium	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Strontium	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}Iodine	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D

Table A-1. Data Summary--Data from 1989 to 1990. (sheet 6 of 6)

TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
AA = atomic absorption spectroscopy.
GC = gas chromatography.
MS = mass spectrometry.
ICP = inductively-coupled plasma spectroscopy.

References:

ASTM--"1986 Annual Book of ASTM Standards", American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA--Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST--Methods of the United States Testing Company, Incorporated, Richland, Washington.

SM--"Standard Methods for the Examination of Water and Wastewater", 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA--"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX B

DATA SUMMARY--DATA FROM 1986 TO 1990

This page intentionally left blank.

Table B-1. Data Summary. (sheet 1 of 9)

Constituent	Sample #	Date	Method	Result
Arsenic (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Arsenic (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Arsenic (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Barium	50020	9/18/85	ICP	2.60E+01
Barium	50057	6/02/86	ICP	2.90E+01
Barium	50093	7/23/86	ICP	3.10E+01
Barium	50161	10/22/86	ICP	2.30E+01
Barium	50226	1/21/87	ICP	3.00E+01
Barium	50822	12/01/89	ICP	3.00E+01
Barium	51000	3/02/90	ICP	2.80E+01
Barium	51048	3/14/90	ICP	3.00E+01
Barium	51083	3/22/90	ICP	2.90E+01
Barium (EP Toxic)	50822E	12/01/89	ICP	<1.00E+03
Barium (EP Toxic)	51000E	3/02/90	ICP	<1.00E+03
Barium (EP Toxic)	51048E	3/14/90	ICP	<1.00E+03
Barium (EP Toxic)	51083E	3/22/90	ICP	<1.00E+03
Boron	50822	12/01/89	ICP	1.10E+01
Boron	51000	3/02/90	ICP	3.30E+01
Boron	51048	3/14/90	ICP	2.40E+01
Boron	51083	3/22/90	ICP	1.00E+01
Cadmium (EP Toxic)	50822E	12/01/89	ICP	<1.00E+02
Cadmium (EP Toxic)	51000E	3/02/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51048E	3/14/90	ICP	<1.00E+02
Cadmium (EP Toxic)	51083E	3/22/90	ICP	<1.00E+02
Calcium	50020	9/18/85	ICP	1.70E+04
Calcium	50057	6/02/86	ICP	1.73E+04
Calcium	50093	7/23/86	ICP	1.68E+04
Calcium	50161	10/22/86	ICP	1.65E+04
Calcium	50226	1/21/87	ICP	2.00E+04
Calcium	50822	12/01/89	ICP	1.77E+04
Calcium	51000	3/02/90	ICP	1.78E+04
Calcium	51048	3/14/90	ICP	1.82E+04
Calcium	51083	3/22/90	ICP	1.79E+04
Chloride	50020	9/18/85	IC	1.19E+03
Chloride	50057	6/02/86	IC	<5.00E+02
Chloride	50093	7/23/86	IC	5.98E+02
Chloride	50161	10/22/86	IC	7.03E+02
Chloride	50226	1/21/87	IC	8.87E+02
Chloride	50822	12/01/89	IC	9.00E+02
Chloride	51000	3/02/90	IC	9.20E+02
Chloride	51048	3/14/90	IC	1.00E+03
Chloride	51083	3/22/90	IC	9.00E+02
Chromium (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Chromium (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Chromium (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Chromium (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Copper	50020	9/18/85	ICP	<1.00E+01
Copper	50057	6/02/86	ICP	<1.00E+01

Table B-1. Data Summary. (sheet 2 of 9)

Constituent	Sample #	Date	Method	Result
Copper	50093	7/23/86	ICP	<1.00E+01
Copper	50161	10/22/86	ICP	<1.00E+01
Copper	50226	1/21/87	ICP	1.60E+01
Copper	50822	12/01/89	ICP	3.10E+01
Copper	51000	3/02/90	ICP	2.20E+01
Copper	51048	3/14/90	ICP	<1.00E+01
Copper	51083	3/22/90	ICP	1.20E+01
Fluoride	50020	9/18/85	IC	<5.00E+02
Fluoride	50057	6/02/86	IC	<5.00E+02
Fluoride	50093	7/23/86	IC	<5.00E+02
Fluoride	50161	10/22/86	IC	<5.00E+02
Fluoride	50226	1/21/87	IC	<5.00E+02
Fluoride	50822	12/01/89	IC	<5.00E+02
Fluoride	50822	12/01/89	ISE	1.33E+02
Fluoride	51000	3/02/90	IC	<5.00E+02
Fluoride	51000	3/02/90	ISE	1.29E+02
Fluoride	51048	3/14/90	IC	<5.00E+02
Fluoride	51048	3/14/90	ISE	1.16E+02
Fluoride	51083	3/22/90	IC	<5.00E+02
Fluoride	51083	3/22/90	ISE	1.38E+02
Iron	50020	9/18/85	ICP	2.37E+02
Iron	50057	6/02/86	ICP	1.72E+02
Iron	50093	7/23/86	ICP	5.60E+01
Iron	50161	10/22/86	ICP	1.03E+02
Iron	50226	1/21/87	ICP	<5.00E+01
Iron	50822	12/01/89	ICP	<3.00E+01
Iron	51000	3/02/90	ICP	3.50E+01
Iron	51048	3/14/90	ICP	<3.00E+01
Iron	51083	3/22/90	ICP	<3.00E+01
Lead	50020	9/18/85	ICP	<3.00E+01
Lead	50161	10/22/86	GFAA	9.00E+00
Lead	50226	1/21/87	GFAA	<5.00E+00
Lead	50822	12/01/89	GFAA	<5.00E+00
Lead	51000	3/02/90	GFAA	<5.00E+00
Lead	51048	3/14/90	GFAA	<5.00E+00
Lead	51083	3/22/90	GFAA	<5.00E+00
Lead (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Lead (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Lead (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Lead (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Magnesium	50020	9/18/85	ICP	3.85E+03
Magnesium	50057	6/02/86	ICP	3.89E+03
Magnesium	50093	7/23/86	ICP	3.86E+03
Magnesium	50161	10/22/86	ICP	3.62E+03
Magnesium	50226	1/21/87	ICP	4.62E+03
Magnesium	50822	12/01/89	ICP	3.98E+03
Magnesium	51000	3/02/90	ICP	4.17E+03
Magnesium	51048	3/14/90	ICP	4.54E+03
Magnesium	51083	3/22/90	ICP	4.55E+03

Table B-1. Data Summary. (sheet 3 of 9)

Constituent	Sample #	Date	Method	Result
Manganese	50020	9/18/85	ICP	5.30E+01
Manganese	50057	6/02/86	ICP	3.10E+01
Manganese	50093	7/23/86	ICP	9.00E+00
Manganese	50161	10/22/86	ICP	7.00E+00
Manganese	50226	1/21/87	ICP	<5.00E+00
Manganese	50822	12/01/89	ICP	<5.00E+00
Manganese	51000	3/02/90	ICP	<5.00E+00
Manganese	51048	3/14/90	ICP	<5.00E+00
Manganese	51083	3/22/90	ICP	<5.00E+00
Mercury (EP Toxic)	50822E	12/01/89	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51000E	3/02/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51048E	3/14/90	CVAA/M	<2.00E+01
Mercury (EP Toxic)	51083E	3/22/90	CVAA/M	<2.00E+01
Nitrate	50020	9/18/85	IC	<5.00E+02
Nitrate	50057	6/02/86	IC	<5.00E+02
Nitrate	50093	7/23/86	IC	<5.00E+02
Nitrate	50161	10/22/86	IC	<5.00E+02
Nitrate	50226	1/21/87	IC	<5.00E+02
Nitrate	50822	12/01/89	IC	5.00E+02
Nitrate	51000	3/02/90	IC	5.97E+02
Nitrate	51048	3/14/90	IC	<5.00E+02
Nitrate	51083	3/22/90	IC	<5.00E+02
Potassium	50020	9/18/85	ICP	9.30E+02
Potassium	50057	6/02/86	ICP	7.31E+02
Potassium	50093	7/23/86	ICP	7.30E+02
Potassium	50161	10/22/86	ICP	7.15E+02
Potassium	50226	1/21/87	ICP	7.23E+02
Potassium	50822	12/01/89	ICP	6.86E+02
Potassium	51000	3/02/90	ICP	6.85E+02
Potassium	51048	3/14/90	ICP	7.52E+02
Potassium	51083	3/22/90	ICP	7.40E+02
Selenium (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Selenium (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Selenium (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Selenium (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Silicon	50822	12/01/89	ICP	2.22E+03
Silicon	51000	3/02/90	ICP	2.17E+03
Silicon	51048	3/14/90	ICP	2.19E+03
Silicon	51083	3/22/90	ICP	2.03E+03
Sodium	50020	9/18/85	ICP	2.44E+03
Sodium	50057	6/02/86	ICP	2.15E+03
Sodium	50093	7/23/86	ICP	2.36E+03
Sodium	50161	10/22/86	ICP	1.87E+03
Sodium	50226	1/21/87	ICP	2.07E+03
Sodium	50822	12/01/89	ICP	1.89E+03
Sodium	51000	3/02/90	ICP	1.88E+03
Sodium	51048	3/14/90	ICP	2.11E+03
Sodium	51083	3/22/90	ICP	2.03E+03
Strontium	50020	9/18/85	ICP	<3.00E+02

Table B-1. Data Summary. (sheet 4 of 9)

Constituent	Sample #	Date	Method	Result
Silver (EP Toxic)	50822E	12/01/89	ICP	<5.00E+02
Silver (EP Toxic)	51000E	3/02/90	ICP	<5.00E+02
Silver (EP Toxic)	51048E	3/14/90	ICP	<5.00E+02
Silver (EP Toxic)	51083E	3/22/90	ICP	<5.00E+02
Strontium	50057	6/02/86	ICP	<3.00E+02
Strontium	50093	7/23/86	ICP	<3.00E+02
Strontium	50161	10/22/86	ICP	<3.00E+02
Strontium	50226	1/21/87	ICP	<3.00E+02
Strontium	50822	12/01/89	ICP	8.80E+01
Strontium	51000	3/02/90	ICP	9.50E+01
Strontium	51048	3/14/90	ICP	9.80E+01
Strontium	51083	3/22/90	ICP	9.60E+01
Sulfate	50020	9/18/85	IC	1.10E+04
Sulfate	50057	6/02/86	IC	1.01E+04
Sulfate	50093	7/23/86	IC	8.21E+03
Sulfate	50161	10/22/86	IC	8.41E+03
Sulfate	50226	1/21/87	IC	1.15E+04
Sulfate	50822	12/01/89	IC	8.90E+03
Sulfate	51000	3/02/90	IC	1.03E+04
Sulfate	51048	3/14/90	IC	1.06E+04
Sulfate	51083	3/22/90	IC	1.02E+04
Thallium	50822	12/01/89	GFAA	7.00E+00
Thallium	51000	3/02/90	GFAA	<5.00E+00
Thallium	51048	3/14/90	GFAA	<5.00E+00
Thallium	51083	3/22/90	GFAA	<5.00E+00
Uranium	50020	9/18/85	FLUOR	7.59E-01
Uranium	50057	6/02/86	FLUOR	8.09E+00
Uranium	50093	7/23/86	FLUOR	7.11E-01
Uranium	50161	10/22/86	FLUOR	5.55E+00
Uranium	50226	1/21/87	FLUOR	5.18E-01
Uranium	50822	12/01/89	FLUOR	3.27E+00
Uranium	51000	3/02/90	FLUOR	5.75E-01
Uranium	51048	3/14/90	FLUOR	7.36E-01
Uranium	51083	3/22/90	FLUOR	6.88E-01
Zinc	50020	9/18/85	ICP	7.20E+01
Zinc	50057	6/02/86	ICP	1.00E+01
Zinc	50093	7/23/86	ICP	5.00E+00
Zinc	50161	10/22/86	ICP	<5.00E+00
Zinc	50226	1/21/87	ICP	8.00E+00
Zinc	50822	12/01/89	ICP	<5.00E+00
Zinc	51000	3/02/90	ICP	6.00E+00
Zinc	51048	3/14/90	ICP	5.00E+00
Zinc	51083	3/22/90	ICP	<5.00E+00
Ammonia	50020	9/18/85	ISE	<5.00E+01
Ammonia	50093	7/23/86	ISE	<5.00E+01
Ammonia	50161	10/22/86	ISE	1.12E+02
Ammonia	50226	1/21/87	ISE	<5.00E+01
Ammonia	50822	12/01/89	ISE	6.30E+01

Table B-1. Data Summary. (sheet 5 of 9)

Constituent	Sample #	Date	Method	Result
Ammonia	51000	3/02/90	ISE	<5.00E+01
Ammonia	51048	3/14/90	ISE	<5.00E+01
Ammonia	51083	3/22/90	ISE	<5.00E+01
Bis(2-ethylhexyl) phthalate	50020	9/18/85	ABN	5.10E+02
Bis(2-ethylhexyl) phthalate	50057	6/02/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50093	7/23/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50161	10/22/86	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50226	1/21/87	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	50822	12/01/89	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	51000	3/02/90	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	51048	3/14/90	ABN	<1.00E+01
Bis(2-ethylhexyl) phthalate	51083	3/22/90	ABN	<1.00E+01
1-Butanol	50822	12/01/89	DIGC	<1.00E+04
1-Butanol	51000	3/02/90	DIGC	<1.00E+04
1-Butanol	51000B	3/02/90	VOA	4.00E+01
1-Butanol	51000T	3/02/90	VOA	3.90E+01
1-Butanol	51048	3/14/90	DIGC	<1.00E+04
1-Butanol	51083	3/22/90	DIGC	<1.00E+04
Dichloromethane	50020	9/18/85	VOA	<1.00E+01
Dichloromethane	50057	6/02/86	VOA	<1.00E+01
Dichloromethane	50057B	6/02/86	VOA	1.85E+02
Dichloromethane	50093	7/23/86	VOA	<1.00E+01
Dichloromethane	50093B	7/23/86	VOA	1.40E+02
Dichloromethane	50161	10/22/86	VOA	<1.00E+01
Dichloromethane	50226	1/21/87	VOA	<1.00E+01
Dichloromethane	50226B	1/21/87	VOA	5.40E+01
Dichloromethane	50822	12/01/89	VOA	<5.00E+00
Dichloromethane	50822B	12/01/89	VOA	1.55E+03
Dichloromethane	50822T	12/01/89	VOA	1.70E+03
Dichloromethane	51000	3/02/90	VOA	<5.00E+00
Dichloromethane	51000B	3/02/90	VOA	<5.00E+00
Dichloromethane	51000T	3/02/90	VOA	<5.00E+00
Dichloromethane	51048	3/14/90	VOA	<5.00E+00
Dichloromethane	51048B	3/14/90	VOA	<3.00E+00
Dichloromethane	51048T	3/14/90	VOA	<5.00E+00
Dichloromethane	51083	3/22/90	VOA	<5.00E+00
Dichloromethane	51083B	3/22/90	VOA	<5.00E+00
Dichloromethane	51083T	3/22/90	VOA	<5.00E+00
Alkalinity (Method B)	50822	12/01/89	TITRA	5.40E+04
Alkalinity (Method B)	51000	3/02/90	TITRA	5.80E+04
Alkalinity (Method B)	51048	3/14/90	TITRA	5.90E+04
Alkalinity (Method B)	51083	3/22/90	TITRA	5.80E+04
Alpha Activity (pCi/L)	50020	9/18/85	Alpha	3.69E-01
Alpha Activity (pCi/L)	50057	6/02/86	Alpha	1.41E+01
Alpha Activity (pCi/L)	50093	7/23/86	Alpha	1.26E+00
Alpha Activity (pCi/L)	50161	10/22/86	Alpha	3.48E+02
Alpha Activity (pCi/L)	50226	1/21/87	Alpha	6.65E-01
Alpha Activity (pCi/L)	50822	12/01/89	Alpha	5.09E+00
Alpha Activity (pCi/L)	51000	3/02/90	Alpha	9.48E-01

Table B-1. Data Summary. (sheet 6 of 9)

Constituent	Sample #	Date	Method	Result
Alpha Activity (pCi/L)	51048	3/14/90	Alpha	<8.65E-01
Alpha Activity (pCi/L)	51083	3/22/90	Alpha	<3.76E-01
Beta Activity (pCi/L)	50020	9/18/85	Beta	1.41E+00
Beta Activity (pCi/L)	50057	6/02/86	Beta	1.68E+01
Beta Activity (pCi/L)	50093	7/23/86	Beta	3.25E+00
Beta Activity (pCi/L)	50161	10/22/86	Beta	5.76E+01
Beta Activity (pCi/L)	50226	1/21/87	Beta	5.74E+00
Beta Activity (pCi/L)	50822	12/01/89	Beta	2.37E+00
Beta Activity (pCi/L)	51048	3/14/90	Beta	2.31E+00
Beta Activity (pCi/L)	51083	3/22/90	Beta	<1.92E+00
Conductivity (µS)	50020	9/18/85	COND-Fld	1.41E+02
Conductivity (µS)	50057	6/02/86	COND-Fld	1.30E+01
Conductivity (µS)	50093	7/23/86	COND-Fld	1.50E+02
Conductivity (µS)	50161	10/22/86	COND-Fld	1.50E+02
Conductivity (µS)	50226	1/21/87	COND-Fld	1.63E+02
Conductivity (µS)	50822	12/01/89	COND-Fld	1.38E+02
Conductivity (µS)	51000	3/02/90	COND-Fld	1.23E+02
Conductivity (µS)	51048	3/14/90	COND-Fld	1.35E+02
Conductivity (µS)	51083	3/22/90	COND-Fld	1.27E+02
Ignitability (°F)	50822E	12/01/89	IGNIT	2.10E+02
Ignitability (°F)	51000E	3/02/90	IGNIT	2.10E+02
Ignitability (°F)	51048E	3/14/90	IGNIT	2.02E+02
Ignitability (°F)	51083E	3/22/90	IGNIT	1.96E+02
pH (dimensionless)	50020	9/18/85	PH-Fld	8.15E+00
pH (dimensionless)	50057	6/02/86	PH-Fld	6.88E+00
pH (dimensionless)	50093	7/23/86	PH-Fld	6.43E+00
pH (dimensionless)	50161	10/22/86	PH-Fld	6.40E+00
pH (dimensionless)	50226	1/21/87	PH-Fld	5.14E+00
pH (dimensionless)	50822	12/01/89	PH-Fld	6.25E+00
pH (dimensionless)	51000	3/02/90	PH-Fld	7.40E+00
pH (dimensionless)	51048	3/14/90	PH-Fld	7.22E+00
pH (dimensionless)	51083	3/22/90	PH-Fld	7.23E+00
Reactivity Cyanide (mg/kg)	50822E	12/01/89	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51000E	3/02/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51048E	3/14/90	DSPEC	<1.00E+02
Reactivity Cyanide (mg/kg)	51083E	3/22/90	DSPEC	<1.00E+02
Reactivity Sulfide (mg/kg)	50822E	12/01/89	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51000E	3/02/90	DTITRA	<1.00E+02
Reactivity Sulfide (mg/kg)	51048E	3/14/90	DTITRA	<1.00E+02
TDS	50822	12/01/89	TDS	6.60E+04
TDS	51000	3/02/90	TDS	6.40E+04
TDS	51048	3/14/90	TDS	6.90E+04
TDS	51083	3/22/90	TDS	7.90E+04
Temperature (°C)	50020	9/18/85	TEMP-Fld	2.28E+01
Temperature (°C)	50057	6/02/86	TEMP-Fld	3.65E+01
Temperature (°C)	50093	7/23/86	TEMP-Fld	3.08E+01
Temperature (°C)	50161	10/22/86	TEMP-Fld	3.49E+01
Temperature (°C)	50226	1/21/87	TEMP-Fld	1.82E+01
Temperature (°C)	50822	12/01/89	TEMP-Fld	1.61E+01

Table B-1. Data Summary. (sheet 7 of 9)

Constituent	Sample #	Date	Method	Result
Temperature (°C)	51000	3/02/90	TEMP-Fld	9.70E+00
Temperature (°C)	51048	3/14/90	TEMP-Fld	1.02E+01
Temperature (°C)	51083	3/22/90	TEMP-Fld	1.27E+01
TOC	50020	9/18/85	TOC	1.39E+03
TOC	50057	6/02/86	TOC	2.22E+03
TOC	50093	7/23/86	TOC	1.73E+03
TOC	50161	10/22/86	TOC	<9.77E+02
TOC	50226	1/21/87	TOC	1.31E+03
TOC	50822	12/01/89	TOC	<1.20E+03
TOC	51000	3/02/90	TOC	<9.00E+02
TOC	51048	3/14/90	TOC	1.10E+03
TOC	51083	3/22/90	TOC	1.00E+03
Total Carbon	50822	12/01/89	TC	1.45E+04
Total Carbon	51000	3/02/90	TC	1.51E+04
Total Carbon	51048	3/14/90	TC	1.55E+04
Total Carbon	51083	3/22/90	TC	1.55E+04
TOX (as Cl)	50020	9/18/85	TOX	<6.35E+00
TOX (as Cl)	50057	6/02/86	TOX	<9.95E+00
TOX (as Cl)	50093	7/23/86	TOX	<1.12E+01
TOX (as Cl)	50161	10/22/86	TOX	<1.00E+02
TOX (as Cl)	50226	1/21/87	LTOX	3.02E+01
TOX (as Cl)	50822	12/01/89	LTOX	1.10E+01
TOX (as Cl)	51000	3/02/90	LTOX	1.20E+01
TOX (as Cl)	51048	3/14/90	LTOX	1.10E+01
TOX (as Cl)	51083	3/22/90	LTOX	1.50E+01
^{60}Co (pCi/L)	50822	12/01/89	GEA	<1.18E-01
^{60}Co (pCi/L)	51000	3/02/90	GEA	<5.33E-02
^{60}Co (pCi/L)	51048	3/14/90	GEA	1.23E+00
^{60}Co (pCi/L)	51083	3/22/90	GEA	1.10E+00
$^{239/240}Pu$ (pCi/L)	51000	3/02/90	AEA	<1.75E-03
$^{239/240}Pu$ (pCi/L)	51048	3/14/90	AEA	<2.65E-03
$^{239/240}Pu$ (pCi/L)	51083	3/22/90	AEA	6.24E-03
^{234}U (pCi/L)	50822	12/01/89	AEA	1.59E+00
^{234}U (pCi/L)	51000	3/02/90	AEA	3.43E-01
^{234}U (pCi/L)	51048	3/14/90	AEA	3.41E-01
^{234}U (pCi/L)	51083	3/22/90	AEA	3.36E-01
^{235}U (pCi/L)	50822	12/01/89	AEA	1.90E-01
^{235}U (pCi/L)	51000	3/02/90	AEA	2.41E-02
^{235}U (pCi/L)	51048	3/14/90	AEA	<5.56E-03
^{235}U (pCi/L)	51083	3/22/90	AEA	<5.75E-03
^{238}U (pCi/L)	50822	12/01/89	AEA	1.17E+00
^{238}U (pCi/L)	51000	3/02/90	AEA	3.16E-01
^{238}U (pCi/L)	51048	3/14/90	AEA	2.82E-01
^{238}U (pCi/L)	51083	3/22/90	AEA	2.66E-01

Table B-1. Data Summary. (sheet 8 of 9)

NOTES:
Sample # is the number of the sample. See Section 3.0 for corresponding chain-of-custody number.
Date is the sampling date.
Results are in parts per billion (ppb) unless otherwise indicated.

The following table lists the methods that are coded in the method column.

Code	Analytical Method	Reference
ABN	Semivolatile Organics (GC/MS)	USEPA-8270
AEA	^{241}Americium	UST-20Am01
AEA	Curium Isotopes	UST-20Am/Cm01
AEA	Plutonium Isotopes	UST-20Pu01
AEA	Uranium Isotopes	UST-20U01
ALPHA	Alpha Counting	EPA-680/4-75/1
ALPHA-Ra	Total Radium Alpha Counting	ASTM-D2460
BETA	Beta Counting	EPA-680/4-75/1
BETA	^{90}Strontium	UST-20Sr02
COLIF	Coliform Bacteria	USEPA-9131
COLIFMF	Coliform Bacteria (Membrane Filter)	USEPA-9132
COND-Fld	Conductivity-Field	ASTM-D1125A
COND-Lab	Conductivity-Laboratory	ASTM-D1125A
CVAA	Mercury	USEPA-7470
CVAA/M	Mercury-Mixed Matrix	USEPA-7470
DIGC	Direct Aqueous Injection (GC)	UST-70DIGC
DIMS	Direct Aqueous Injection (GC/MS)	"USEPA-8240"
DSPEC	Reactive Cyanide (Distillation, Spectroscopy)	USEPA-CHAPTER 7
DTITRA	Reactive Sulfide (Distillation, Titration)	USEPA-CHAPTER 7
FLUOR	Uranium (Fluorometry)	ASTM-D2907-83
GEA	Gamma Energy Analysis Spectroscopy	ASTM-D3649-85
GFAA	Arsenic (AA, Furnace Technique)	USEPA-7060
GFAA	Lead (AA, Furnace Technique)	USEPA-7421
GFAA	Selenium (AA, Furnace Technique)	USEPA-7740
GFAA	Thallium (AA, Furnace Technique)	USEPA-7841
IC	Ion Chromatography	EPA-600/4-84-01
ICP	Atomic Emission Spectroscopy (ICP)	USEPA-6010
ICP/M	Atomic Emission Spectroscopy (ICP)-Mixed Matrix	USEPA-6010
IGNIT	Pensky-Martens Closed-Cup Ignitability	USEPA-1010
ISE	Fluoride-Low Detection Limit	ASTM-D1179-80-B
ISE	Ammonium Ion	ASTM-D1426-D
LALPHA	Alpha Activity-Low Detection Limit	EPA-680/4-75/1
LEPD	^{129}Iodine	UST-20I02
LSC	^{14}C	UST-20C01
LSC	Tritium	UST-20H03
LTOX	Total Organic Halides-Low Detection Limit	USEPA-9020
PH-Fld	pH-Field	USEPA-9040
PH-Lab	pH-Laboratory	USEPA-9040
SPEC	Total and Amenable Cyanide (Spectroscopy)	USEPA-9010
SPEC	Hydrazine-Low Detection Limit (Spectroscopy)	ASTM-D1385
SSOLID	Suspended Solids	SM-208D

Table B-1. Data Summary. (sheet 9 of 9)

TC	Total Carbon	USEPA-9060
TDS	Total Dissolved Solids	SM-208B
TEMP-Fld	Temperature-Field	Local
TITRA	Alkalinity-Method B (Titration)	ASTM-D1067B
TITRA	Sulfides (Titration)	USEPA-9030
TOC	Total Organic Carbon	USEPA-9060
TOX	Total Organic Halides	USEPA-9020
VOA	Volatile Organics (GC/MS)	USEPA-8240

Analytical Method Acronyms:
- AA = atomic absorption spectroscopy.
- GC = gas chromatography.
- MS = mass spectrometry.
- ICP = inductively-coupled plasma spectroscopy.

References:

ASTM--"1986 Annual Book of ASTM Standards", American Society for Testing and Materials, Philadelphia, Pennsylvania.

EPA--Various methods of the U.S. Environmental Protection Agency, Washington, D.C.

UST--Methods of the United States Testing Company, Incorporated, Richland, Washington.

SM--"Standard Methods for the Examination of Water and Wastewater", 16th ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, D.C.

USEPA--"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", 3rd ed., SW-846, U.S. Environmental Protection Agency, Washington, D.C.

This page intentionally left blank.